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# A Mechanical Mathematician

By

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IN THE days when business was spelled in ordinary lower-case letters the multiplication table was considered a quite useful adjunct to the business office. Everybody in the office, from the old man down (or up) to the office boy, was supposed to have a working knowledge of this table, and the more thorough the knowledge, other things being somewhere near equal, the better was the possessor's chance for advancement.

The clerk who could dissect this table, work it upside down, inside out, forward or backward, generally attained early to the exalted position of "head bookkeeper," and in a manufacturing plant the head bookkeeper was a personage of importance, not infrequently being the paymaster, the purchasing agent, the factory manager, the employment bureau and pretty much everything else in the way of management—a regular "pooh-bah" around the place, whose good graces it was well to cultivate and whose displeasure was a thing to be avoided.

Later, since business has come to be spelled with a big B, the mathematical adjunct has grown in importance to a point where the multiplication table, from being a tool with which to demonstrate one's skill, has become the ruling power, the fetish before which all else must make obeisance. In short, from being their master, business has become the slave of figures.

The hurry and bustle of business offices, the enormous amounts, whether of money or material, represented by the figures, the magnitude of disasters consequent upon error long since indicated the necessity for the elimination of the human element of fallibility, and for nearly fifty years certain mathematically inclined minds with a genius

## I. Development of the Machine

***Of all the mechanical appurtenants to modern business, few occupy a more substantial or fundamental position than the computing, or calculating machine. The volume of figures to be handled; the necessity for speed and accuracy; the serious losses that may, and probably will, attend upon error, all demand that the burden of computation be lifted from the human brain. The machine described in this article is one of many that will shoulder this burden and, entirely eliminating the personal factor, carry out its exacting and intricate details with mechanical certainty and precision.***

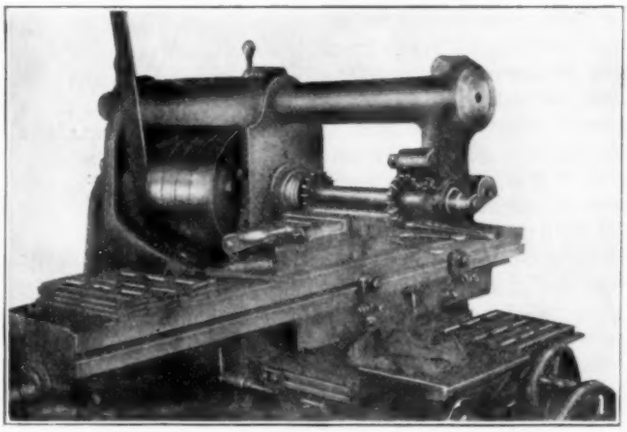


FIG. 1. MILLING THE FRAME SPACERS

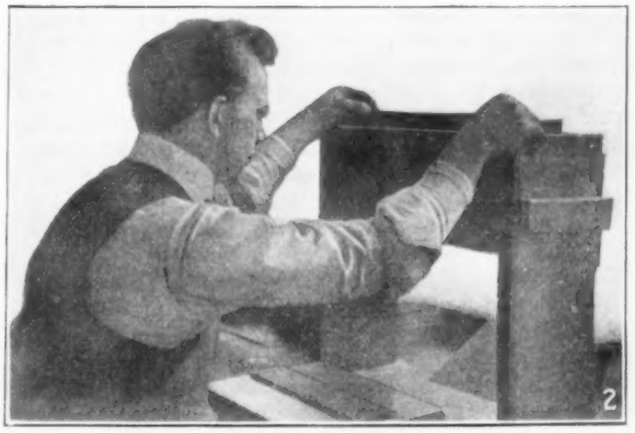


FIG. 2. TESTING FOR STRAIGHTNESS

for mechanics have been experimenting, developing and perfecting the means by which the burden of computation may be shifted from the overworked and not always sure brain of the mathematician to the unemotional and inexorable certainty of the machine.

### Early Computing Machine

One of the earliest practical attempts to shift the drudgery of mathematical computation from man to machine is recorded in the United States patent granted to Frank S. Baldwin in 1874. A model of the machine on which this patent was issued is shown to the right in the headpiece and was built at the Reliance Machine Works, Philadelphia, Penn.

During the intervening years Mr. Baldwin has been at work developing and perfecting his machine, which has passed through many stages and assumed varied appearances, each housing some mechanical modification of the one general principle, until the present stage of its evolution is reached in the machine shown at the left.

FIGS. 3, 4 AND 5. FLATTENING PLATES, STRAIGHTENING SMALL PARTS AND THE FLATTENING MACHINE
Fig. 3—Flattening a keyboard plate. Fig. 4—Straightening small parts. Fig. 5—A flattening machine

The purpose of this article is to give a summary of the construction and action of the machine, and in so doing take up each detail that may involve or suggest difficult or unusual methods of production, describing the way in which it is manufactured and in some instances illustrating the tools used.

### One General Principle

All calculating and computing machines are built on one general principle, and that a very simple one. Each key movement sets certain parts of the machine in position to bring corresponding dials to designated figures when the crank or lever is moved, and when by addition or multiplication a dial figure becomes more than nine, or by subtraction or division, less than 0, certain other parts are brought into action to pass along the job of registering to the next higher or lower dial as the case may be.

Some machines are made to print each operation step by step on a paper ribbon after the manner of a typewriter, while others indicate only the result on a dial or, as in some cases, all the factors that produce the result. For instance, the machine under discussion will, when multiplication is performed, show, through the medium of keyboard and upper and lower dials respectively, the multiplicand, multiplier and product when the work is finished. In division it will show in the same order divisor, quotient and remainder. In performing addition it shows not only the sum but the number of items added together to produce it. These machines will perform any mathematical computation involving any combination of the four fundamental functions of arithmetic and will show the result with unerring certainty in less time than would ordinarily be required to set down the principal figures by hand.

The machine here described is built by the Monroe Calculating Machine Co. at its factory in Orange, N. J. The buildings now occupied by the company were taken over from a concern in an entirely different line of endeavor, and while they are not ideal for the purposes of their present owners they have been well adapted to the work in hand.

They are of modern mill construction and are practically fireprof. The main buildings are of brick, four stories high, with concrete floors which are overlaid with maple, giving all the advantages of a wooden floor and the fire protection of concrete. Two brick-and-concrete towers have been added, which house the stairways, elevators and lavatories.

A power plant occupies a detached building, which also contains the hardening and the enameling departments; thus all elements that might be a source of danger from fire are segregated in a building in which there is nothing combustible except the fuel, and as far enough removed from the main buildings to eliminate the fire hazard. The power transmission is entirely electric.

The principal material from which the machine is constructed is cold-rolled steel, and this is received at the factory in the form of sheets, bars and coils. A small amount of brass is used, some iron castings and a quantity of die castings. The storage rooms are separate buildings and are so located that the stock goes directly to the first operations in the press and automatic departments on the ground floor whence scrap material can be removed direct without the expense of hoisting the extra weight above ground level and without tying up elevators in useless work.

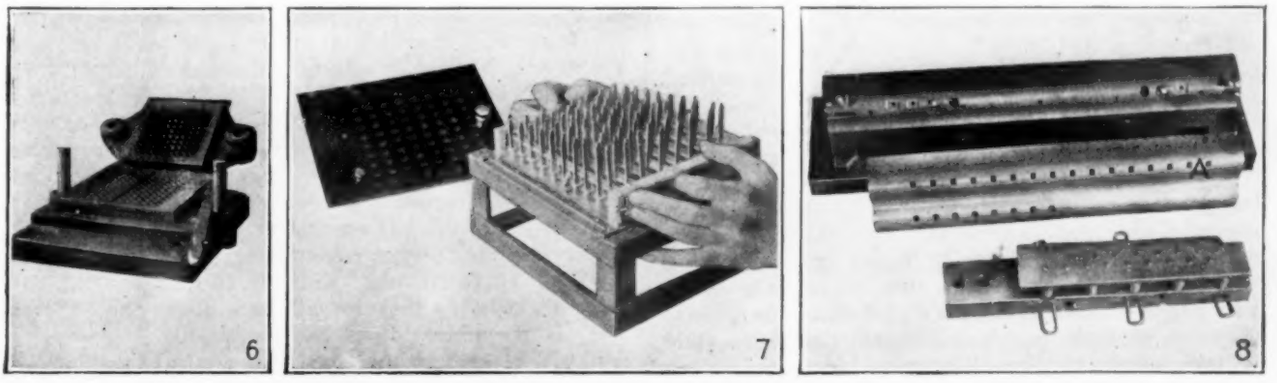
The general plan is to have the work progress steadily from the ground level to the top floor where under the best conditions of light the final assembling and testing are done. Thus there is nothing to be brought down by the elevators except the finished machines, and these of course represent the smallest possible weight which the material can assume.

The main frame of the machine is built up from sections of sheet steel of 0.072 gage held together by

spacers of gray iron. The spacers are milled to length by passing between a pair of side milling cutters and are held to very close limits. The operation is shown in Fig. 1. Bearing spots on the sides of the spacers are also finished, the work being done on Pratt & Whitney vertical grinding machines.

The larger parts of the case, which are made of cold-rolled steel, are cut to size on a roll shear, it having been found more practicable to produce many of these parts in this way than to maintain the heavy presses and costly dies that would be necessary to blank them. There is also less waste of material.

Cold-rolled sheet steel, although apparently flat is far from being accurately so, and as the pieces that go to make up the frame or case of this machine are required to be flat to a considerable degree of accuracy there is a department devoted entirely to the flattening and straightening of them and to straightening the rods and shafts of which the operating part of the machine is comprised.




FIGS. 6, 7 AND 8. PIERCING TOOLS AND KEYBOARD PARTLY ASSEMBLED
Fig. 6—Tools for piercing the keyboards. Fig. 7—Keyboard partly assembled. Fig. 8—Tools for piercing carriage cover

It is no easy matter to flatten a piece of sheet steel so that it will stay flat, as will readily be acknowledged by any amateur who has tried it, and to flatten such pieces rapidly and accurately is an operation that requires skill and judgment acquired only through years of experience. This fact was primarily recognized by sawmakers, who by acquiring proficiency in this art brought into existence the craft known as sawsmithing.

The average man who desired to flatten a warped piece of sheet steel (and there are none that are not warped, regardless of the manner in which they are produced) would probably lay the offending piece on an anvil or bench plate and hit the high spots with a hammer, gaging the truth of the sheet as he proceeded by looking along its edge and by rocking it on the bench plate. If he succeeded at all, the surface of the sheet would probably be full of minute depressions caused by the hammer and the flatness would be the result of opposing surface strains induced by the peening action. When the surface was polished, the marks would be glaringly apparent if left in, while if taken out the surface strains would be removed and the sheet assume its original shape.

Sawsmithing, or as it is sometimes called, saw hammering, has for years been looked upon as an art rather than an exact science, and its acquirement a matter of instinct and temperament rather than the following of cut-and-dried rules. This idea is rather intensified to the casual onlooker by the mysterious manner in which the old-time sawsmith goes about his work and the altogether surprising and (to the uninitiated) unexpected results that follow a series of blows delivered anywhere but what appears to be the right place. One old sawmaker when asked how he knew where to hit a crooked saw, replied that he "carefully figured out the most likely place to hit it, and then hit it somewhere else."

In the straightening department at the Monroe plant are employed a number of these old-time sawsmiths who learned their trade in such shops as Disstons, Simonds, Atkins, etc., and who by virtue of long experience are able to flatten a piece to test true in less time than the before-mentioned average man would require to determine where to hit it.

All of the plates, shafts and rods of the operating mechanism and even the gears and counting wheels pass through this department and are flattened, straightened or otherwise manipulated to make them function properly in the machine, the work being tested for truth with special gages, straight-edges and surface plates. Figs. 2, 3, and 4 show some of these operations.

While much of this work is done with the peculiar shaped hammers of the sawsmith a new method has been developed by the foreman, Mr. Grant, for flattening the plates used to make the case. A standard make of foot press was used as a basis for the flattening machine; the lever was taken out and a pinion substituted which meshes with a rack on the press gate, and a new treadle connection provided so that while only a comparatively light blow may be delivered the action is very quick and not so tiresome to the operator as a regular foot press.

The "tools" used are made of wood faced with leather, and with this rig an operator familiar with the work may flatten a warped plate in an astonishingly short space of time. This method has the advantage of doing the work without marring the surface, and there is less liability of the plates returning to their original shape when subjected to further operations. The machine is shown in Fig. 5.

One of the pieces to be flattened is the keyboard plate. This part is in fact two plates, each pierced with 81 rectangular holes for the key stems as well as several holes for other purposes. These plates are not subjected to the flattening process until after the piercing operation. One of the plates may be seen in Fig. 3.

The tools for piercing the keyboard plates are shown in Fig. 6. They are of the pillar type and pierce all

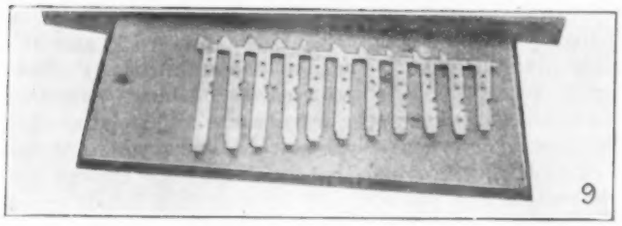



FIG. 9. A SET OF KEY STEMS

holes for the key stems at once. The punches are removable and any required combination of them can be used for piercing keyboards other than standard. The holes pierced by this tool are slightly smaller than is required in the finished plate.

It is very desirable to have the key stems a close fit in the plate, and for that reason the holes are made smaller than is required and are later subjected to an individual broaching operation, which is done in a foot press with a broach that has a pilot to fit the pierced holes. This broach leaves the holes smooth and exactly to size. In Fig. 7 is a partly assembled keyboard showing the jig in which the assembling is done, the key stems, springs, lock-washers and key locks, also the cast-iron spacers which separate the two plates comprising the board.

The cover of the machine carriage is made from sheet steel rolled to the required shape at the mills. One of the sets of tools for piercing the little windows in this part is shown in Fig. 8, one of the covers being shown at *A*. As will be noticed in this picture the punch covers only a portion of the die. The work passes these tools twice, with the punch in different positions. Only alternate holes are pierced at each setting, and this method permits a much stronger die construction than would be possible if the holes were as closely spaced in the die as they are needed in the work. It also enables the body of the die to be made of soft material while the actual cutting edges are supplied by tool-steel bushings. The ends of the carriage are die castings.

A considerable portion of the "works" of a calculating machine consists of toothed wheels which to the uninitiated would seem to be gears, but most of these are counting wheels and the mating member is either the pins on the "clutch" or the "dogs" on the "carrying shaft." There are, however, a number of bona fide gears in the machine, and these are cut in the usual manner.

The counting wheels are blanked and pierced in compound dies, each piece coming from the tools complete, including the teeth and all necessary holes in the web. They are then straightened and flattened and are ground to thickness on a Bristol surface-grinding machine, after which they are subjected to a shaving operation in a compound die, which is very much like the blanking die, but which takes off but a small amount of stock, leaving the wheel exact in size and perfect in form.

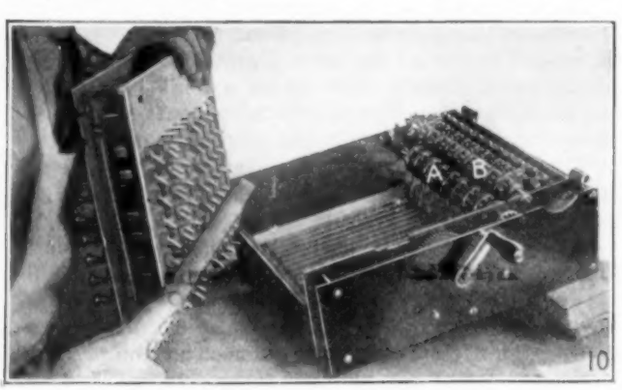



FIG. 10. FITTING UP A KEYBOARD

The wheels of the "clearing-out train" as well as some of the operating wheels are in effect intermittent gears and are produced in the same manner as the counting wheels except that the smooth portion of their periphery, which must be perfectly concentric, is finished with a small profiling cutter, the work being held in a fixture which feeds the gear to the cutter, turns it about its own center until the cutter has milled the smooth portion and then withdraws it.

Another product of the press department requiring great accuracy is the key stems shown in Fig. 9. There are nine registering keys and a clearing key to each column, and there is the general clearing key to the right of the key bank, making 11 kinds of key stems.

From one of the lower corners of each first registering key stem, or "1" key, there extends a narrow wedge-like projection the office of which is to move or "set" a part which directly affects the counting wheel. On the stems of keys "2," "3" and "4" this wedge is increasingly wider, the resultant movement of the "set" corresponding. On the "5" key there is no projection from this corner, but there is one on the opposite corner, which is repeated without variation on keys "6," "7," "8" and "9." These last four keys all have two projections each, one corresponding to the "5" key and the other corresponding relatively to the "1," "2," "3" and "4" keys, so that for all keys above the "5" the "set" is a combination of two movements.

It will be evident therefore that accurate methods of production are required, as the range of movement is quite limited and it must be divided by at least five to differentiate one key from another. The method of production is the same as in the case of the counting wheels, the stems being blanked and shaved with compound dies.

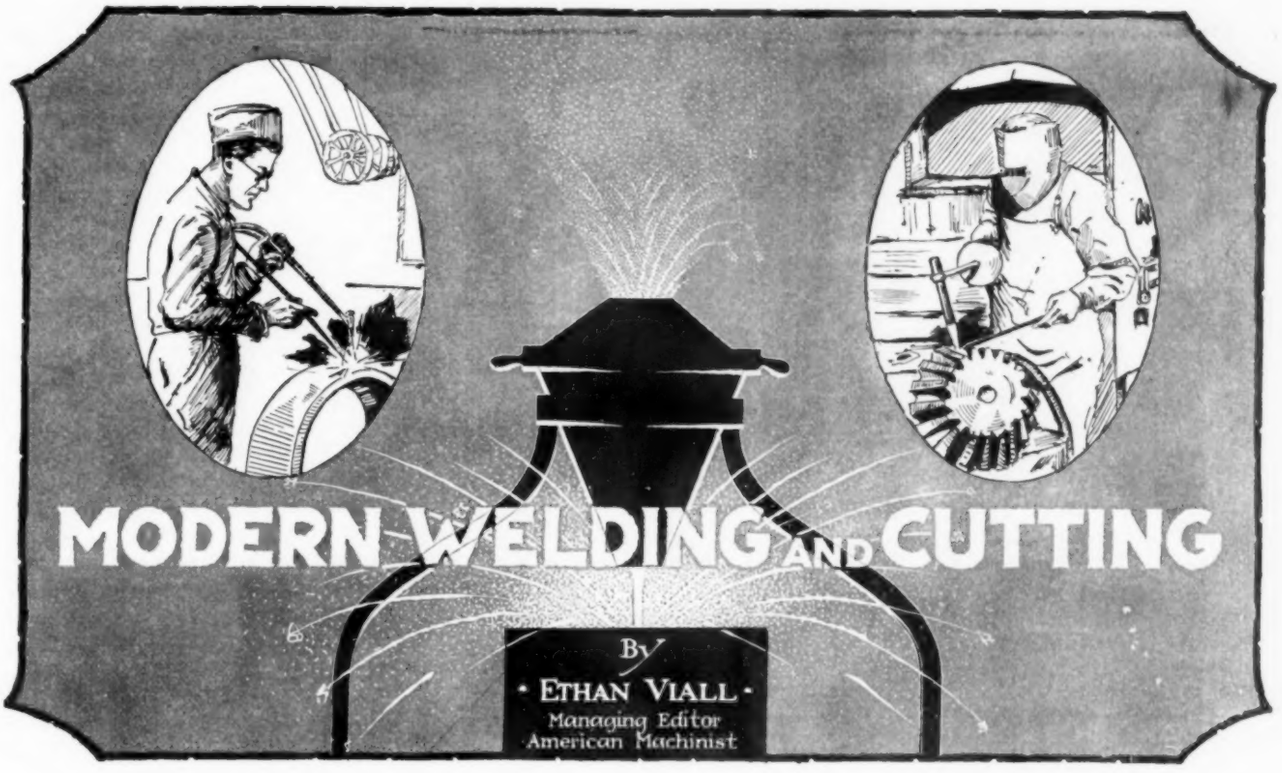
Fig. 10 will serve to show the arrangement of the keys in the key bank with reference to the various wedge-shaped projections. In this cut the workman is adjusting a keyboard after assembling to correct any error that may interfere with the accurate registering of the keys.

The assembling of the machine will be taken up in a subsequent article and further operation described.

## How Would You Prevent This Grinding Trouble?

By J. S. Damon

Referring to the query on page 705 of the *American Machinist*, I believe that the work can be done on a Simplex grinding machine. The grinding medium in this machine is a belt to which the abrasive (emery, corundum, or similar material) is affixed by glue or cement. This rapidly moving belt is supported from the inside by a plane surface of cast iron, therefore presenting a broad flat surface completely covering the surface of the article to be ground. The grinding is accomplished all at once instead of removing the metal a little at a time by a point of contact moving to and fro as in the wheel type of grinding machine. It is my opinion that the piece described by Mr. Vernon can be handled satisfactorily on this machine.




# XI. Low-Pressure Acetylene and Thermalene Generators*

*The details of the latest type of low-pressure acetylene generator will be of interest to every mechanic having anything to do with gas-torch welding. Thermalene generation is a very unique proposition and was first noted in the "American Machinist," Aug. 10, 1916.*

THE use of a low-pressure acetylene generator, the pressure of which is limited to 1 lb. or less, makes it possible to use a gasometer for the storage of the generated gas, with its accompanying advantage of absolute volumetric or pressure control. A phantom view of a typical low-pressure generator, made by the Oxweld Acetylene Co., is shown in Fig. 102. The carbide-feeding mechanism and tank closely resemble that of the pressure type, and with the exception of the gasometer and its mechanism, the rest of the apparatus resemble it also.

The possibility of loss of gas through ordinary leakage in the line and connections is practically eliminated with the low-pressure system. The gas bell *A* provides storage for gas and effectively guards against the loss due to after-generation. Control of the carbide-feed mechanism is accomplished through the rise and fall of the gas bell, giving a very constant gas pressure. The movement of the gas bell gives a dual motor control, first through a carefully adjusted friction brake, which provides for gradual starting and stopping, and, second, through a positive jaw clutch. Special provision is made for shutting off the motor feed when the gas bell is in its lowest position, which might result from a severe leak in the line or connections.

Operation of the generator is effected by a small but efficient weight-driven motor *B*, which is automatically started and stopped in proportion to the amount of gas being used. The motor weights *C* always lower approximately the same distance for each pound of carbide used, and constitute a reliable indication of the amount of carbide remaining in the machine at any time. The generator requires no attention whatever other than periodic recharging with carbide and water. By the use of a positive forced feed, it is impossible for more than the proper quantity of carbide to be fed to the water at a time. In order to secure cool, and hence efficient, generation, it is necessary to have not less than one gallon of water capacity per pound of carbide charge. This requirement is met by all of these generators.

A complete and efficient system of interlocking safety devices prevents mistakes in operation due to carelessness or forgetfulness when charging the generator. The hydraulic back-pressure valve with three distinct water seals, prevents the possibility of any oxygen entering the generator.

The generator is equipped with an agitator *D*, which churns the residuum thoroughly, allowing it to flow out freely and quickly when the residuum outlet is opened for recharging. These low-pressure generators use the nut, or 1¼ x ⅜-in. size carbide.

### The Oxweld Duplex Generators

The duplex form of generator, shown in Fig. 103, is designed to meet the requirements of many industries, where continuous operation of the generator, without interruption for cleaning or repairing, is essential. It is made up of two of the low-presure generators, both delivering to the same gasometer. Either generator can be operated independent of the other, allowing one to be used while the other is being recharged. The

*For the author's forthcoming book, "Welding and Cutting."
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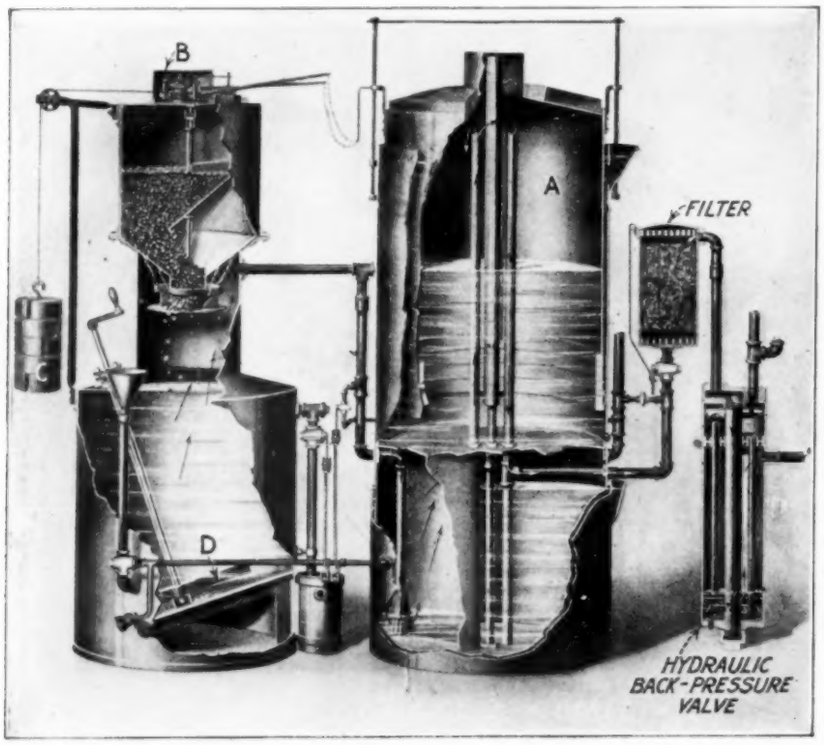



FIG. 102. SECTIONAL VIEW OF OXWELD LOW-PRESSURE GENERATOR SHOWING INTERIOR ARRANGEMENT AND DIRECTION OF FLOW OF GAS

low-pressure generators are made in a number of sizes, details of which are given in Table VIII.

Reputable manufacturers always supply detailed instructors as to the care and maintenance of their generators. These should be posted in a permanent

TABLE VIII. OXWELD LOW-PRESSURE GENERATOR SIZES

| Carbide Capacity in Pounds | Single or Duplex | Gas Capacity Cu. Ft. Per Hour | Approx. No. of Blow-pipes | DIMENSIONS | | | Approx. Shipping Weight, Complete Plant | Min. Width of Door Through Which Gen. will Pass |
|---|---|---|---|---|---|---|---|---|
| | | | | Height | Length | Width | | |
| 50 | Single | 50 | 3 | 7′ 4″ | 5′ 7″ | 3′ 2″ | 1400 | 29½″ |
| 50 | Duplex | 50 | 3 | 7′ 4″ | 8′ 10″ | 3′ 2″ | 1800 | 29½″ |
| 100 | Single | 100 | 6 | 7′ 6″ | 6′ 2″ | 3′ 7″ | 1900 | 33″ |
| 100 | Duplex | 100 | 6 | 7′ 6″ | 9′ 8″ | 3′ 7″ | 2400 | 33″ |
| 200 | Single | 200 | 12 | 9′ 4″ | 8′ 0″ | 5′ 0″ | 2500 | 41″ |
| 200 | Duplex | 200 | 12 | 9′ 4″ | 13′ 0″ | 5′ 0″ | 3500 | 41″ |
| 300 | Single | 300 | 18 | 10′ 1″ | 8′ 10″ | 5′ 4″ | 4100 | 48″ |
| 300 | Duplex | 300 | 18 | 10′ 1″ | 14′ 1″ | 5′ 4″ | 4800 | 48″ |
| 500 | Single | 500 | 30 | 11′ 7″ | 11′ 3″ | 6′ 6″ | 4800 | 62″ |
| 500 | Duplex | 500 | 30 | 11′ 7″ | 18′ 0″ | 6′ 6″ | 6300 | 62″ |

place near the generator and should be strictly adhered to in setting up, starting, and refilling.

The following general precautions should always be observed:

In charging a generator never use anything but the hands or a wooden stick to poke the carbide, on account of the danger of causing a spark.

As far as practicable do all charging, cleaning, adjusting, and manipulating of the generator by daylight.

Avoid as far as possible the introducing of air into the generator, or the circulation of air through it. Never leave any opening in the machine open longer than is necessary and never have any two openings, such as the carbide charging door and the sludge valve, open at the same time.

Keep the generator full of water at all times, even when not in use. When the sludge is drawn off and the machine flushed out, do not do anything else until it has been refilled as directed in the instructions for recharging it.

Never open the carbide filling plug, charge the machine with carbide, do any adjusting or manipulating, or make repairs, unless the generating chamber is full of water, as directed in the instructions for operating the generator.

Renew the water in the generating chamber each time any carbide is placed in the hopper. Never run more than one charge of carbide into the generating chamber without refilling with fresh water. Do not experiment.

If water in any chamber of the generator should freeze, do not attempt to thaw it with anything but hot water; and then examine the generator carefully for any damage which freezing may have caused.

If the generator should ever require repair: First, remove all carbide; second, drain all water from the generating chamber, then refill the generating chamber as if for recharging; third, disconnect the generator from piping and remove it to the open air, then fill all the compartments with water and thus force out all mixtures of gas and air before applying soldering irons or any tools that could cause a spark. See that the workmen removing or repairing the generator understand this thoroughly.

Familiarize yourself thoroughly with the directions for operating your generator, which are furnished by its makers; and when recharging the machine follow them in the order in which they are given.

In composition and method of production, thermalene differs from any gas previously used for welding pur-

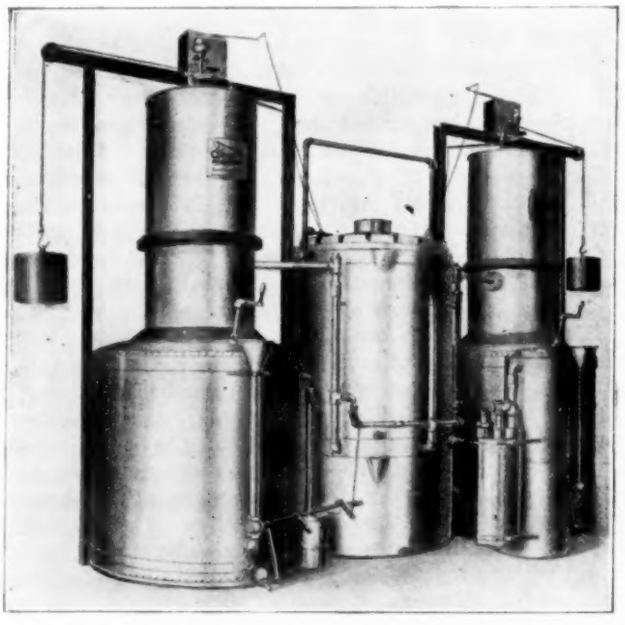


FIG. 103. OXWELD LOW-PRESSURE ACETYLENE GENERATOR, DUPLEX TYPE

poses. It is a combination produced by the decomposition of calcium carbide and hydrocarbon oils, the heat generated by the carbide being used to vaporize the oil. It is the discovery of Karl Frederich Linus Wolf, of Zurich, Switzerland, and is handled in this country by the Thermalene Co., Chicago Heights, Ill.

At present thermalene is principally used for welding or cutting metals, in which it is used together with the proper mixture of oxygen. The nature of the gas will be better understood by first giving a description of the method by which it is produced.

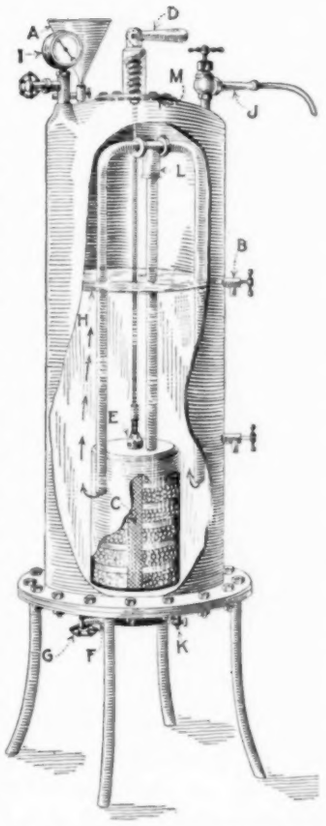



FIG. 104. PHANTOM VIEW OF THERMALENE GENERATOR

A phantom view of a generator is shown in Fig. 104. To prepare this generator for operation, water is poured in through funnel *A* until it will run out of pet-cock *B*, which fills the casing about two-thirds full. The generating mixture is carried in a tin can or cartridge that is inserted from the bottom into the cartridge chamber, as shown at *C*. Previous to inserting the cartridge, however, care is taken to pull down the cam lever *D*, which pulls up the rod and closes the water valve *E*. This prevents any water entering the cartridge chamber. After the cartridge has been inserted through the door in the bottom of the chamber, the door is closed and the bar *F* brought up and locked by means of the handwheel *G*. To generate gas the cam lever on top is pulled up as far as it will go. This admits water from the water chamber *H* into the cartridge chamber through the center tube to the bottom of the cartridge, from where it begins to work upward.

### How the Cartridge Is Packed

The cartridge is packed with alternate layers of calcium carbide and crude oil mixed with sawdust. The water as it rises slacks the carbide and generates acetylene gas. The heat caused by the slacking of the carbide layer vaporizes the oil in the layer of mixed oil and sawdust immediately above the layer of slacking carbide and generates oil-gas. When the gas pressure as indicated by the gage is up to 5 lb., the valve *J* is opened, which lets the gas enter the hose leading to the storage tank or torch. The pet-cock at *K* is used to drain off the impurities, such as phosphor-hydrogen or ammonia, which have been separated from the carbide gas in the process of generation. At *L* is a check valve, which allows gas to escape from the cartridge chamber, but effectually prevents any return of either gas or water. As soon as a cartridge is exhausted it is easily removed, carrying all of the dirt and sludge with it.

With the use of a storage tank, enough gas is carried to run a torch while a new cartridge is being put in place in the generator, if needed. The pressure limit for welding or cutting is 15 lb. When this pressure is reached, a regulating diaphragm at *M* automatically cuts off the water feed and stops the generation of gas. This diaphragm is placed at the top of the generator, on the inside, where the gas pressure acts directly on it. The diaphragm is connected to the feed-valve rod in the center, so that as the diaphragm is forced upward by the gas pressure, the water valve is partly or wholly closed. It is so arranged as to be easily set for various desired pressures.

As previously stated, the cartridges are made up of alternate layers of calcium carbide and oil-soaked sawdust. Now it is well known that the volume of lime into which calcium carbide is converted by the slacking process is greater than the volume of the carbide. Therefore, when carbide is packed tightly in cartridges, as desirable, the expansion is liable to burst the case, and in some instances might cause the cartridge to jam in the chamber, as well as interfere with the successful working. One of the objects then is to so make the cartridge as to allow for the expansion of the contents. Another is to prevent the oil from coming in contact with the carbide, as this would interfere with the action and decrease the gas output. To summarize, the cartridge components must be so arranged as to promote free action of the carbide; free action of the heat evolved from the carbide on the volatile substance; to prevent action of moisture on the carbide layers not being acted upon purposely; and to promote the free discharge of the generated and volatilized gases.

All of these points, as well as a number of others, have been considered in the makeup of the cartridges, as shown in detail in Fig. 105. As made at present for commercial purposes, there are four sizes corresponding to the different outfits. The cartridges consist of a tin can of suitable size, the smallest being 4¾ in. in diameter and 8 in. high, weighing 6 lb. and having a gas-producing capacity of 25 cu.ft., sufficient to supply a welding torch from four to five hours. The largest size is 9¾ in. in diameter and 16 in. high, weighing 40 lb. This has a gas production of 200 cu.ft., or eight times the capacity of the smallest size which has been previously mentioned.

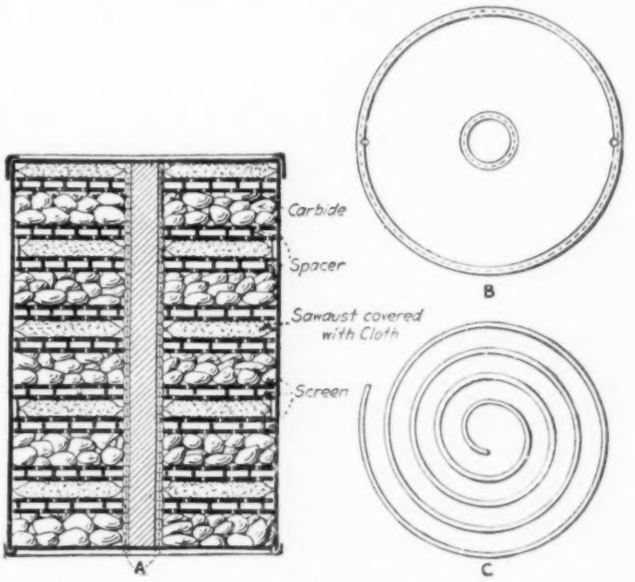



FIG. 105. DETAILS OF THERMALENE CARTRIDGE

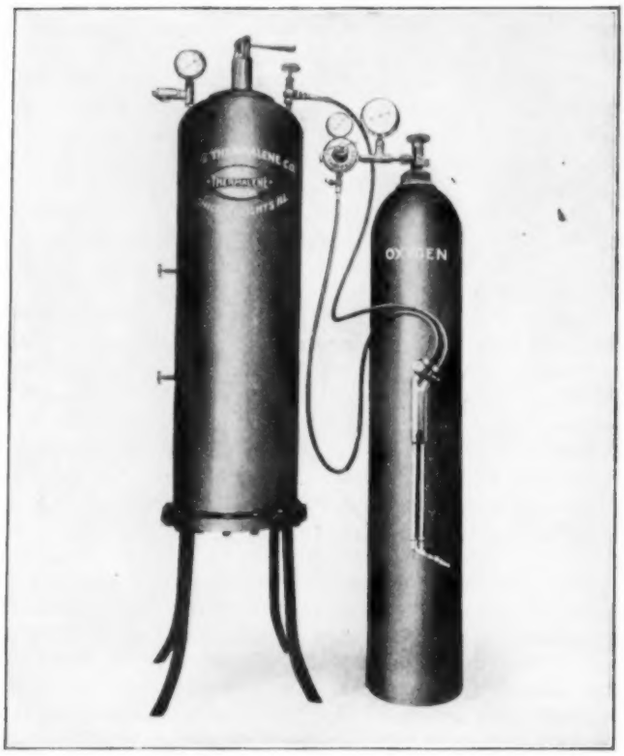



FIG. 106. THERMALENE OUTFIT FOR SHOP USE

Referring now to the illustration, a cylindrical screen *A* is first placed in the can to be filled and then a layer of carbide is placed in the bottom of the can around the screen tube. An unglazed carboard disk *B* is next placed on top of the carbide. A spacer *C*, made of thin metal bent so as to lie edgewise, is placed on top of the cardboard and then a disk of screen is put over it. Sawdust impregnated with crude oil in a cloth sack made of two cloth disks sewed together is laid on the screen. On this is another screen, then a spacer and a cardboard disk, and so on to the top, ending with a sack of oil-soaked sawdust covered with a piece of screen that has no hole in the center for the cylindrical tube. The end of the can is closed with a cover for handling, which is removed before placing in a generator.

As previously mentioned, the water feeding in through the valve in the cartridge chamber drips down through the cylindrical screen tube and starts slacking of the lower layer of carbide, the heat of which vaporizes the oil in the sack above it. The cardboard disks, while strong enough to hold the layers firmly in place while dry, begin to soak up as soon as the feeding starts, and consequently become soft, so as to give way under the pressure of the expanding carbide, allowing it to be forced into the spacing between the carbide and the oily sawdust. This space is so calculated as to keep the various layers firmly in place until the cartridge is exhausted. Another thing is that, as any liberated steam or water vapor must pass through the absorbent cardboard as well as the oil, before it reaches the next layer of carbide, action of the steam on the carbide above is prevented. This insures that the respective layers of carbide will not be acted upon until the water becomes level with them in turn. In consequence, a cartridge can remain in a generator a long time without becoming spent. The screen disks on top and bottom of each layer of oily sawdust furnish efficient volatilization and egress for the gas.

By the method of producing thermalene, the heat evolved by the generation of acetylene is absorbed, at the place of generation, in the production of the oil gas. This utilization of heat serves to keep the temperature down, since the heat generated is used and dissipated by the latent heat of the oil, so that radiation and absorption by water is not necessarily depended upon. The gas combination that results passes out through the T-pipe ends and bubbles up through the water into the upper part of the generator. The low temperature causes the impurities to drain back into the chamber, from which they are easily removed. The layers of carbide and oily sawdust are so proportioned as to cause only the vaporization of the lighter oils, such as benzine, naphthalene, kerosene and the like. The temperature is not high enough to vaporize the tar oils, as these are heavy and give a deposit of lampblack. These heavy oils are therefore not utilized, but remain in the cartridge. The temperature in the cartridge is maintained between 200 and 300 deg. C. (392 to 572 deg. F), depending upon the rapidity with which the gas is being used and the amount which is generated and delivered. It is not intended that an actual boiling take place at any time, for if the temperature is too high there will be a vaporization of the heavy oils, causing deposits in the pipes and also an increase in the impurities. The gases passing through the pipes cooled by the water of the generator are kept between 60 and 70 deg. F. In the passage through the cooled pipes the impurities are removed in the following manner: Acetylene has a comparatively high specific heat, so that its rate of cooling when passing through the pipes is low. The specific heat of oil gas is, however, only one-eighth of that of acetylene, so that its cooling effect will be eight times as great. Now if the two gases are passed together along a cooling surface, the temperature of low specific heat will decrease rapidly and cause a rapid lowering of the temperature of the other gas. This causes a deposit of the vapors suspended therein. So this action results in the deposit of the sulphur, phosphorus and silicon compounds, and of the ammonia. In order, however, to bring about this precipitation the temperature must be

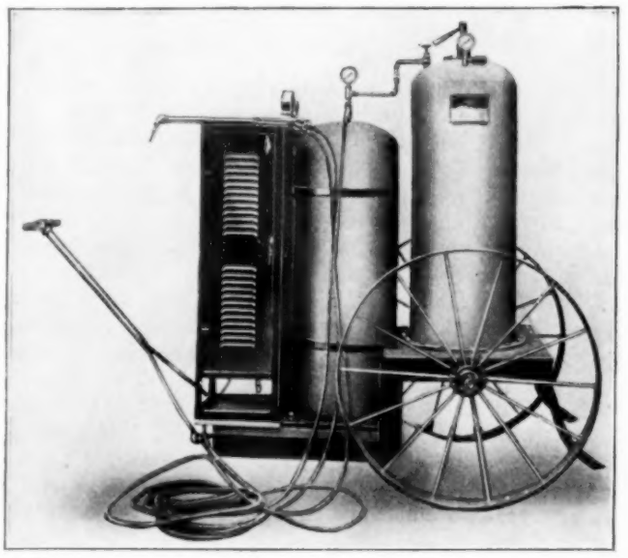


FIG. 107. PORTABLE THERMALENE GENERATOR OUTFIT

sufficiently low—that is, as stated above, between 60 and 70 deg. F. If the gas finally issuing from the pipes and water was too hot, the impurities would not be thrown out.

In this process the acetylene and oil gas, generated and cooled, will combine in the pipes after the impurities are removed. It is important, however, that the impurities be removed and the product sufficiently cooled, since no real combination will take place at too high a temperature. For instance, if the water is above 180 deg. F. the oil burns and no proper combination results.

The combined gas produced, named thermalene, possesses marked characteristics that distinguish it from oil-gas, from acetylene, and from the usual mixture of the two. The density is greater than air, being 1.1 taking air as unity. The issuing gas can be seen to sink when thrown through a sunbeam. The specific heat is low, being a little over one-eighth of that of acetylene. Thermalene liquefies at between 1400- and 1500-lb. pressure per square inch at room temperature, and in its liquid state is nonexplosive and stable. A very noticeable thing is the odor, which is not at all like the odor of either acetylene or of oil-gas, but is a soft, sweet smell, not strong or offensive in any way. The color is white, but with a predominating proportion of the red and yellow parts of the spectrum. The maximum flame temperature, according to H. McCormack, professor of chemical engineering, Armour Institute of Technology, Chicago, Ill., has been found to be about 6500 deg. F. The high density of the gas has a number of advantages. It has more body than acetylene and does not need so much oxygen. Moreover, it mixes better with oxygen. It does not explode as readily as acetylene, so can be mixed with greater proportions of air. In a Bunsen burner it is possible to mix as much as 32 per cent. of air without causing a flareback. It can readily be turned down without causing a flareback, and it can be used with a Welsbach mantle to advantage. The upper and lower explosive limits are 12 per cent. and 30 per cent. It averages approximately 13.97 cu.ft. per pound.

### Some Advantages of Thermalene

When used for welding and cutting, thermalene has numerous good points. It does not require an excess of oxygen, and the flame, therefore, produces a soft weld, especially in cast iron. When welding it is noticeable that less sparks are thrown off than when using acetylene. It can be used at a lower pressure also, owing to its greater calorific value. Owing to the removal of the various impurities, there are no corrosive effects on fittings, nor poisonous effects. It is also for this reason that there is little or no danger of explosion. Neither does the spent cartridge give off explosive gases, for the reason that the gases liable to cause explosion are separated and drained off from the generator chamber. Corrosion of interior walls, due to water action, is prevented by the oil vapor which is always present and forms a protecting and sealing effect throughout.

A thermalene generator may discharge its gas into a storage tank, or the gas may be used direct from generator to torch. A welding or cutting outfit, suitable for shop use, where it will not need to be moved frequently, is shown in Fig. 106. Here the gas is used direct from generator to torch. The smallest generator like the one shown is 10½ in. in diameter, stands 3 ft. 9 in. high, and weighs about 60 lb. An apparatus mounted on a truck is shown in Fig. 107. As a rule a No. 2 generator is used for this purpose. This size is 16 in. in diameter, stands 6 ft. high, and will produce 70 cu.ft. of gas with one charge, the generator weighing 225 lb. and the storage tank 120 lb. The largest size generators will produce 200 cu.ft. of gas per charge, and they may be coupled in batteries where a large amount of gas is desired. These can be arranged so that part of them can be recharged while the others are working, or storage tanks of sufficient capacity may be used to allow for recharging.

## Former-Plate Construction for Shell Turning

By A. R. Melloy

The construction of former plates for turning shells in a lathe involves a few points that are bound to puzzle the designer in his first attempts at former-plate design. The following description will probably be of some help to shell men in general:

Let it be required to turn the shell $A$ in the figure, using two former plates $B1$ and $B2$ to guide a roller $C$. The roller $C$ operates the tool $D$ by means of rigid connections to the cross-slide of the lathe so that $D$ cannot pivot around $C$ and can only travel parallel to it.

Consider for the present that the shell has only one curve of radius $E$, then the following rules will apply:

a. The radius of the plate $B2$ will be the radius $E$ of the shell.

b. The radius of the plate $B1$ will be the radius $E$ plus the diameter of the roller $C$, or $K = C + E$.

c. The tool for finishing must be ground to the radius of the roller $C$.

d. The roughing tool must bear a definite relation to the finishing tool.

In order to prove rules a and b, imagine a finished shell to be in the machine and a roller $G$ replacing the tool $D$. The center of this roller is rigidly fixed to the center of the roller $C$; therefore these two centers will travel in an arc of a circle of radius $H$ which is the same for both. It is important to establish clearly in mind the fact that the roller $G$, in traveling parallel to $C$, must pivot around a center $J$, which is quite different from the center $I$ around which $C$ pivots.

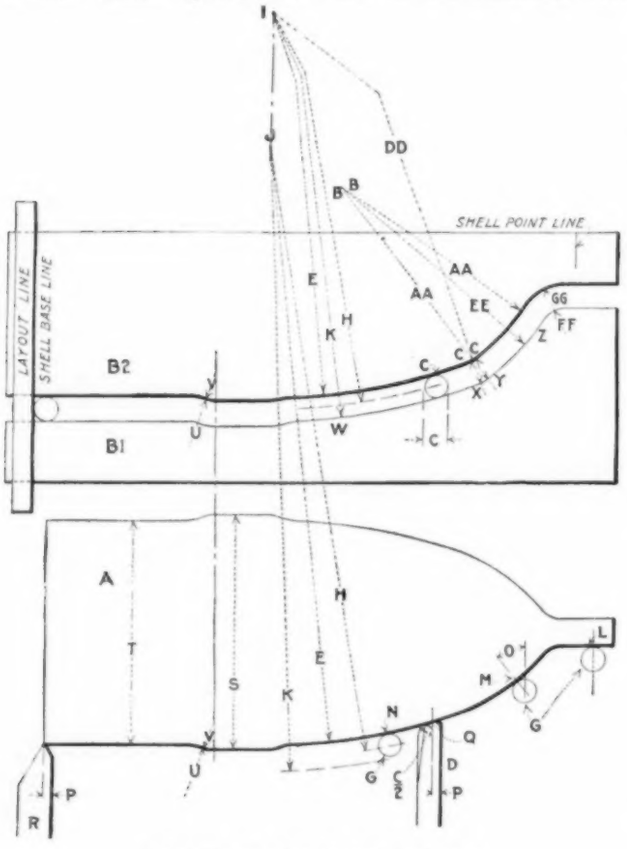
The radius $H$ is equal to the radius $E$ plus the radius of the roller or $H = E + \frac{C}{2}$ and the radius $K$ is equal to the radius $E$ plus the diameter of the roller or $K = E + C$. The radius $K$ of the shell layout corresponds to radius $K$ of the plate $B1$ and radius $E$ of the shell corresponds to radius $E$ of the plate $B2$ by reason of the parallel motions of the two rollers.

In considering rule c the roller $G$ is seen to touch the shell at various points $L$, $M$ and $N$, which are really points of tangency of the two circles, and the cutting point travels on an arc through an angle $O$. Consequently, the cutting edge of the tool must be the arc of a circle which passes through those points and has a radius $\frac{C}{2}$.

Some firms use circular tools held by a special holder, but every grinding of such a tool changes the diameter of the tool and consequently changes the profile of the shell. If a lathe tool is ground with a gage to the

radius of the roller it is always the same, will always give the same results and is the simplest possible.

In considering rule d it is necessary to study *D* in the figure, which shows the roughing tool superimposed on the finishing tool. In both of these tools and in a set-up gage, to be described later, a distance *P* must be established which is the same for all tools and gages, and forms the basis of an "interchangeability" system. The radius $\frac{C}{2}$ necessary for good finishing, will be found too great for roughing and a smaller radius *Q* must be used in the roughing tool




FORMER-PLATE CONSTRUCTION

which may be made to suit the designer, remembering that the smaller the radius *Q* is made, the more metal the roughing tool leaves on for the finishing tool to remove. Conditions might arise where it would be desirable to use two roughing tools in which the second tool might have a radius intermediate between the first and the finishing tool.

For setting up a machine a gage *R* may be used, which is an ordinary threading tool in which the dimension *P* of the tools *D* corresponds to dimension *P* of the gage.

It is necessary that the toolholder shall have a firm side against which the tools can be lined up firmly before clamping. This side constitutes a positive stop for setting the tools and is the reason why the dimension *P* is established in the tools and gage.

The shells should be cut off to a definite depth of cavity so that the shell base can be used as a working point. In mounting in the machine a stop should always locate the base in the same position. Then all that is necessary is to clamp the gage in the toolholder and bring the point touching the base of the shell.

In the former plates three lines are laid out, one corresponding to the point, one to the base and one at a distance equal to the radius of the roller to the rear of the shell-base line.

With the gage *R* at the base of the shell move the former plates till the roller just touches a straightedge laid on the layout line on the formers. Then clamp down the formers, remove the gage and the roughing and finishing tools may be interchanged and shells changed without further setting up. Any variation in the shape of the tools will be sure to cause trouble.

It is evident that a sharp corner cannot be cut with this former, and where a step is made from diameter *S* to diameter *T* it must be done by means of a double radius as at *U* and *V* on both shell and former. The smaller radius *V* should not be less than the radius of the roller and the larger radius *U* is equal to the smaller radius *V* plus the roller diameter, or $U = V + C$.

In certain kinds of shells the point is not one curve, but a compound curve. In these cases the shape of *B*2 is as before the shape of the shell, but the shape of *B*1 is complicated.

Consider four points in plate *B*1 as *WXYZ* and let *BB* be the location of the center of the new radius *AA* involved. From *BB* extend the radius *AA* through the point *CC* and let it pass indefinitely through *Y*. From *I* draw *DD* (equal to *E*) through *CC* and indefinitely through *X*. As before the arc *WX* has a radius $E + C$ or *K*. Arc *YZ* has a radius $AA + C$ or *EE*. Between the points *XY* a new curve is introduced. The center of this arc is *CC* and its radius is equal to *C* or the diameter of the roller.

Radius *FF* may be made any convenient size, its purpose being merely to prevent the corner from wearing. Radius *GG* will then be $FF + C$.

## To Prevent Splattering of Workers

By W. D. Forbes

Every once in a while I run across things in piping that amuse me, and once in a while I make a mistake in judging too hastily. I was astonished, one day, to notice that six milling machines were supplied with soda water from a trunk line, 1½ in. in diameter, but the leads from the line were two inches. Well, I laughed myself almost sick over it, and pointed it out to one of the directors of the company, who joined in the laugh. The super was called to the office and was questioned as to how such a thing could happen in such a well regulated and efficient company. It did not seem to disturb the super at all. He said, "I do not see why the piping was done that way, but I will find out, as my piper is a man that rarely goes wrong and I would like to hear what he has to say about it." So the piper was called, a man well over 50. To my surprise he was not a bit flustered when asked why a 2-in. lead was taken from a 1½-in. run.

"Yes, that looks strange, but I had to do it that way as the men on the millers said they did not want to put up their unbrellas while running the machines. You see," he said, "½-in. pipe was called for, but the soda water came in at such a velocity that it almost drowned the men by splattering, so I cut in "bull heads" and reduced the velocity and we had no more kick."

The next time I see a queer job of piping I will not laugh quite so early in the game.

# The Aims of the American Gear Manufacturers' Association*

By F. W. SINRAM
President of the American Gear Manufacturers' Association and Vice President of the Van Dorn & Dutton Co.

WHILE our mayor has welcomed you to Cleveland in his customary pleasing manner, I would add in behalf of the Cleveland gear manufacturers that we appreciate the good will reflected by your desire to meet here, and are pleased indeed to have you with us. Although our sessions promise to be busy ones, we hope to have the opportunity of showing you at least some little part of our great city, which is justly entitled to the reputation it has achieved for beauty and substantiality.

Industry organization—now generally recognized as a part of the plant of modern business—proved a vital factor in the successful prosecution of the war, and promises to be of equal value during the so-called reconstruction period.

Otto Kahn, the eminent New York banker, in an address before our local Chamber of Commerce recently, said, "The United States is facing the greatest era of prosperity in its history." Apropos of the future, and in harmony with what I have said, he stated, "We have new problems to face, but the American common sense will solve them." Quoting from this same address, Mr. Kahn said further, "This country will stand fast no matter what happens in Europe. The laws restricting business must be modified. The Sherman Law and the Clayton Act had the right motive behind them, but business has outgrown them."

*We bring our second association year to a close, and open the third with our country and business confronted with many large problems. Few question that the future will demand radical changes in many directions. In the evolution which is already under way, coöperation will light the way to many of the problems that will arise. The character and extent of this coöperation will measure the influence of the American Gear Manufacturers' Association, and have a distinct bearing on the stability of our industry. Our association may be of great value to the individual units represented in it.*

Nearly a year ago at White Sulphur Springs, in speaking of our association I remarked, "The foundation has been completed and is substantial." Notwithstanding the unprecedented demands upon industry during the time that has intervened the American Gear Manufacturers' Association has made progress. Membership in the association has become a valuable asset to the gear manufacturer.

Our second year closes with over 60 interests privileged to use its monogram, represented by more than 120 leaders of the art. Few are the representative manufacturers of "cut" gears who are not affiliated with the association. This membership evidences a desire and willingness to coöperate, and an appreciation of the value of the exchange of ideas on subjects of common interest.

Our association includes the producers of all kinds and classes of "cut" gears. Every American Gear Manufacturers' Association gathering demonstrates the value of the comprehensive organization. The association is placing the gear business on the plane merited by its character, scope and importance.

There have always been optimists in the gear industry. Two years ago it also contained pessimists and semi-pessimists. Through the association these have been converted into optimists.

I have mentioned a few of the achievements of the association. What further has it accomplished, and what should be its aims for the future? Let's use the stated objects of the association as a basis of analyzation.

Article II of our constitution provides first for "The discussion of subjects of interest and value to the industry in which its members are engaged." In the several meetings held during the past two years subjects technical, practical and commercial have without exception been ably presented. The experiences and ideas freely exchanged in the discussions that have followed have been of great value. This has led to further discussion and exchange of ideas among the individual representatives. In this manner many troublesome problems have been solved.

The success of our meetings is the personal responsibility of every representative. What subjects have you in mind which could be presented and discussed to the interest of the industry and the trade? Communicate your suggestions to the president or secretary, in order that the executive committee may be guided by your desires in the preparation of programs. When the subjects are announced give them some consideration so that you may come prepared to contribute something of real value in the discussion that takes place after each presentation, all to the end that our meetings of the future may be of even greater profit than those of the past.

Next in order in the stated objects of our association is "the advancement and improvement of that industry." Can we not justly claim that the gear business as an industry has advanced and improved to a greater degree during the past two years than during any similar period in its existence? It will continue to advance and improve to the extent that our organization progresses. To advance and improve the industry is again the direct responsibility of each and every representative. The advancement and improvement of our industry is two phased—technical and ethical. Some can assist in the former—all in the latter. As to the ethical, we cannot place our standard too high. The advancement and improvement of the industry demands standardization—technical and commercial.

The third of the stated objects of our association is "The collection and dissemination of statistics of interest and value to its members." This is a phase of association endeavor possessing possibilities for value to our membership second to none. If developed to the scope possible, the gear manufacturer (member company) will ultimately actually need but one other association affiliation, namely, that relating specifically to labor. The association may at the same time distribute information in this connection which would be of great value.

Any information which may be of interest to our membership as manufacturers, and more particularly as gear manufacturers, may properly be distributed among them. Our sources for securing information and data are manifold. Our committees have information and data to disseminate. Occasions arise where the representatives individually receive information which could be advantageously passed around. Other matter reaches us and will come to us in increased volume through the engineering societies. The Chamber of Commerce of the United States, with which we are affiliated, is supplying much valuable and timely information, especially during these fast-moving times when conditions change over night. The Government itself is another source of information in many connections. A library committee is a new addition to our committees. While originated primarily in the interest of standardization, it will in the course of its operations undoubtedly gather statistics and information on many subjects which might be distributed advantageously.

As to the distribution of statistics and information, four

*Address given at the convention of American Gear Manufacturers' Association, Cleveland, Apr. 15, 1919.

means readily suggest themselves, namely, our present loose-leaf sheets with complete minutes of meetings, including addresses and discussions; loose-leaf sheets for standardization and technical data of all kinds; our present system of bulletins, which you have no doubt found of interest, and a periodical organization publication.

The bulletins would naturally be the means employed for circulating such matter which by its very character should be distributed in this form. Also that in which the element of time is important. On the other hand, a periodical publication could be used to advantage in distributing news pertaining to the industry and a considerable volume of interesting information and data of various kinds.

Fourth in the list of stated objects is "The standardization of gear design, manufacture and application." At White Sulphur Springs I originated the slogan "A gear standard to be a recognized standard should be an American Gear Manufacturers' Association standard." If we are to qualify as an industry we must make progress to this end. The evolution of gear standards is an obligation we owe not only to ourselves but the collective gear purchasers and the engineering world.

While gear standardization in the aggregate is a task of considerable magnitude, a start with the simpler phases will form the foundation on which we may build successfully. To this end our organization for standardization will undoubtedly have some definite and specific standards to recommend for your consideration in the near future.

The demands of the war and other conditions restricted our progress during a part of the year just closing. However, a most successful meeting was held in Buffalo in February solely in the interest of standardization. This meeting and the sessions to be held here promise to be the start to standardization accomplishment.

Last on the list of stated objects of our association is "The promotion of a spirit of coöperation among its members for the improved production and increased application of gears." Every meeting evidences an ever-increasing spirit of coöperation, and has advanced the improved production of gears. As a consequence the business is being more ably conducted. Better gears are being made, and gears are being more economically produced. As to the increased application of gears, individually many of those represented in the association have not been inactive. The very character of the times since our inception has restricted any concerted action.

So much for the defined objects of the association. I would also comment briefly and make some observations on other association activities.

Our commercial standardization committee also met in Buffalo recently. As a consequence definite and specific recommendations will be submitted for your consideration where it is believed the uniformity of practice is desirable.

In addressing you in April last I remarked that "Sooner or later the association must give serious consideration to uniform cost accounting," adding further that the time was probably not far distant when the Government would itself provide in this connection for such industries as did not work out the problem to its satisfaction for themselves. Your committee on uniform cost accounting gave considerable time and thought to this subject, and at the semi-annual meeting in September presented a detailed report with recommendations. Your executive committee should give this further consideration. As in view of the conditions under which we operate now the desirability of uniform cost accounting grows in importance.

Some consideration has been given to a division or bureau to adjust controversies as to product between supplier and purchaser—a plan to insure equitable settlement without litigation. Assist your executive committee with suggestions so that they may recommend some definite plan to the membership for consideration.

While an increasing number of representatives have contributed in no small degree to the progress of the year just closing, our association is especially indebted to Mr. F. D. Hamlin, its secretary and treasurer, and Mr. B. F. Waterman, chairman of the general standardization committee. You all appreciate the extent to which our secretary, ably seconded by his assistant, Miss Benton, has increased the efficiency of his office. As the directing head of our standardization activities Mr. Waterman has the necessary vision and is steadily building for productive results.

Times and conditions considered, the association is to be congratulated on its progress and the present state of the organization. A successful industry organization has been developed under most abnormal conditions and is now available for service when the industry that is not organized will be at a great disadvantage.

To be of greatest benefit to the membership now demands activity in practically every phase of association endeavor. Again, "the success of the association is the responsibility of every representatve."

It has now been my privilege to serve as your president for two years, or since the inception of the organization—an honor in which I shall always take pride. The task has been a pleasant one because of the confidence reposed in me and the consideration accorded me. I shall never forget the evidences of true friendship, loyalty and esteem on the part of the gear men reflected in resolutions, letters, telegrams, etc., from all parts of the United States, when there came to me but a short time since probably the greatest trial I shall ever be called upon to bear.

This sentiment and the loyalty of my associates and friends in general, coupled with my little son, the precious legacy of the one who was ever an inspiration—accomplished, lovable, kind and considerate, a real partner, an ideal mother and a true friend—is lighting the way and helping me to "carry on."

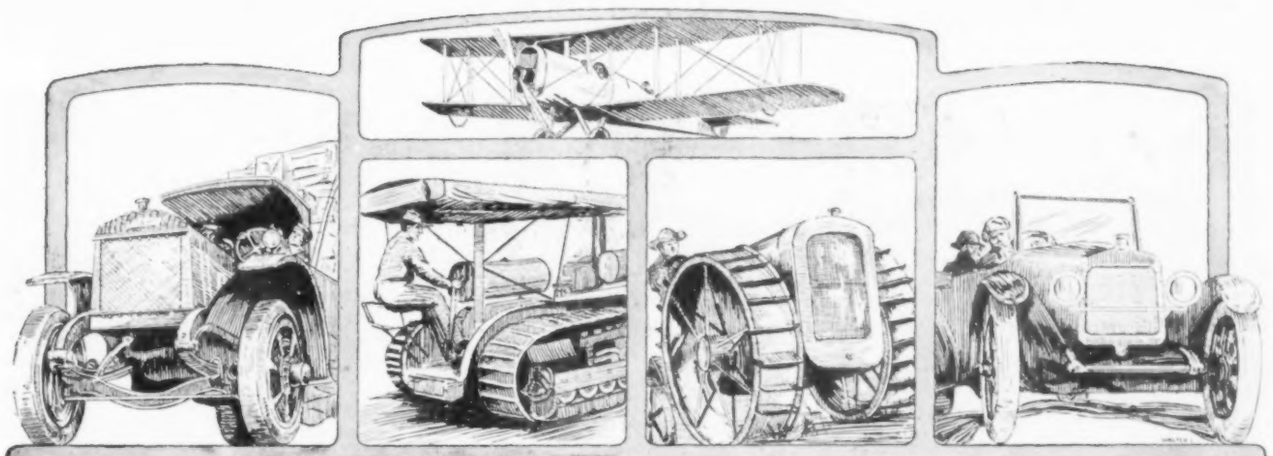
In the interest of the association, may I ask for my successor the same confidence and consideration?

## How Would You Prevent Oil From Discoloring Finished Surfaces?

By Harry Senior

Replying to your query on page 802 of the *American Machinist* as to how the finished surfaces of machine tools may be kept free from the molasses-colored discoloration due to the drying on of oil, the only application known that will positively prevent this is "elbow grease." It must be vigorously and persistently applied to the affected surfaces, preferably through the medium of cotton waste or similar material. Firemen and assistants in engine rooms, apprentices and helpers in machine shops, housemaids in charge of door knobs, etc., have been searching for a substitute for this well-known and justly celebrated reagent ever since Jim Watt discovered that steam came out of a tea kettle, but so far it remains without a serious rival in its field.

It might possibly lessen to some extent the quantity of the aforementioned "grease" required to reduce the molasses-colored discoloration of which you complain if you did not use molasses-colored oil on your machinery but the necessity for it cannot be wholly eliminated even though you use no oil at all.



# AUTOMOTIVE CONSTRUCTION

## Machining a Six-Cylinder Motor—II

By J. V. HUNTER
Western Editor *American Machinist*

*Attention to the smaller parts of this automobile motor has not been neglected in the development of the most efficient machining methods. The reader should ask himself whether or not some of these methods which employ the full capacity of each machine tool could be applied to different types of work in his own machine shop.*

AN EXTENSIVE study of tooling has been made at the plant of the Falls Motor Corporation, Sheboygan Falls, Wis., and some of the methods they employ for loading every machine tool to its full cutting capacity might be applied to other lines of manufacture. No opportunity has been neglected wherever this study has shown that the output of a milling machine can be increased by running a large number of different castings through the machine for each cut by changes which improve the capacity or character of the work-holding fixtures.

The quantity and character of work simultaneously machined on a large Ingersoll milling machine is shown in Fig. 9. There are seven fixtures mounted on the table, which are not identical because they have been adapted to the different pieces they are to carry. The total load at one complete setting of the table consists of six oil pans, 24 cylinder heads, six manifolds and 12 flywheel housings. The cylinder heads require four cuts to finish and the flywheel housings require two, so that after each run, the positions of 12 cylinder heads and six housings must be transposed to bring the other sides up for cutting. By this arrangement after the third run of the milling-machine table six complete sets of these parts are produced on each succeeding run. The time required for one complete travel of the milling-machine table is 25 min., and the runs are followed through continuously by loading and unloading the table while the cuts are being made. Three men are employed in handling the work on this machine.

The milling fixtures used for this work are rather

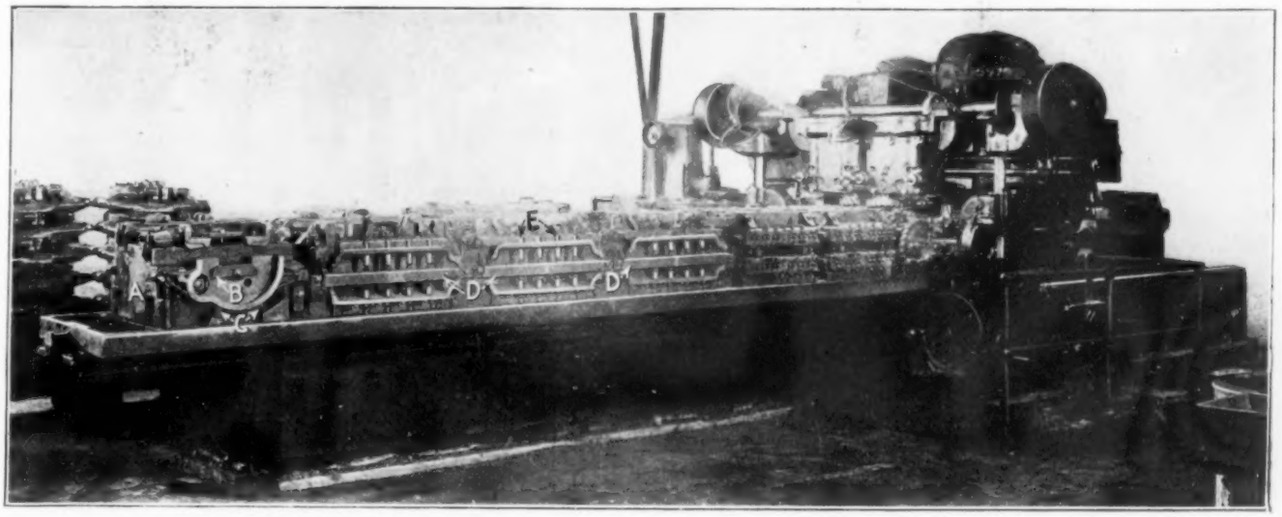



FIG. 9. MILLING MOTOR PARTS IN MULTIPLE

# AUTOMOTIVE CONSTRUCTION

FIG. 10. STORAGE OF CASTINGS

intricate in detail, necessarily so because of the variety of pieces which each carries. The end fixture *A* is devoted to the flywheel housings which rest on suitable stops and are fastened by the clamp *B*. The heavy adjustable screws *C* are provided to take the heavy thrust of the cut. The oil pans are held against the sides of other fixtures by the heavy crossbars *D*, from which small jackscrews *E* extend to the top and bottom to prevent the thrust of the milling cutters from springing them.

The neat and orderly manner in which the many castings are handled about the machines constitutes a lesson on elementary efficiency to machine shops where castings are dumped and piled indiscriminately. The illustration, Fig. 10, shows how hundreds of castings are neatly piled on conveying-truck platforms for transportation to and from the machines.

After the cylinder head has been milled it is carried through a series of Natco drilling-machine operations. The first of these, Fig. 11, is a series of four operations on the different faces by use of an indexing jig. The six drills must drill all 12 valve holes on this side of the piece. This is accomplished by first drilling the left-hand set of six holes with the sliding and revolving jig *C* in the position that it now stands in the main frame *D*. The aligning pin *E* is then lifted and the frame *C* slid to the left on its trunnions *F* until the pin *G* locks into place. This permits the right-hand set of holes to be drilled in their turn.

At the same setting of the cylinder head in the jig the holes on the other side of the castings (which are of identical size) are drilled by revolving the jig on its trunnions. For some of these holes it is necessary to slightly shift the drill spindles, which is accomplished

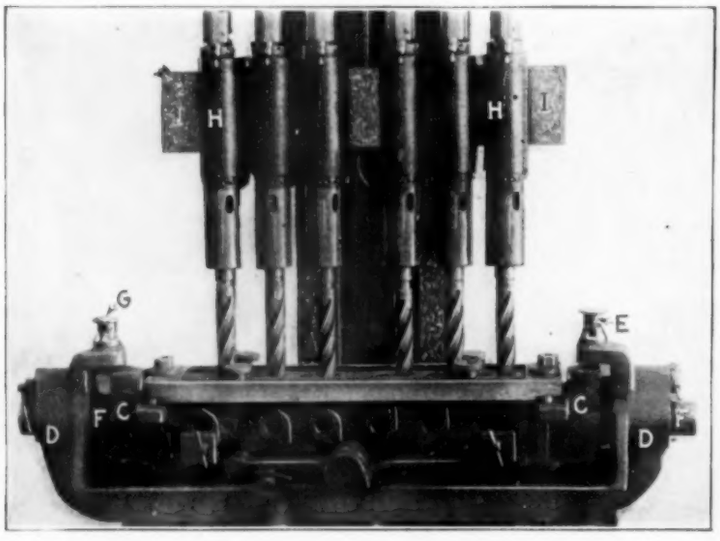



FIG. 11. DRILLING CYLINDER HEADS

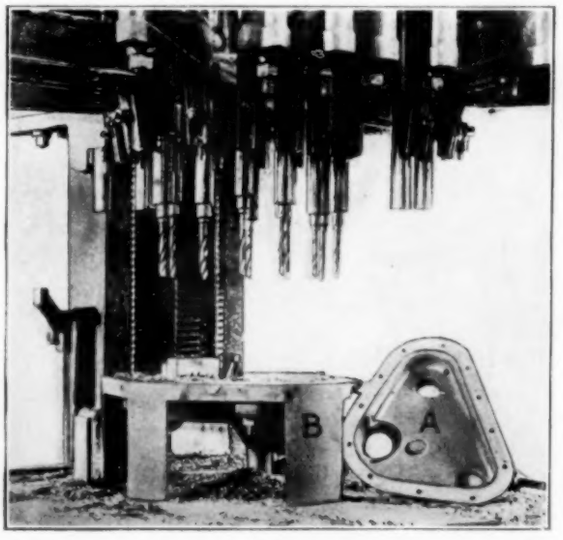



FIG. 12. DRILLING GEAR-CASE COVERS

# AUTOMOTIVE CONSTRUCTION

by releasing the clamping screws that hold the individual sleeves *H* on the crossrail *I*. For all heavy drilling operations on both the cylinder block and head the drills are run at a speed of 90 ft. per minute with a feed of 0.015 in. per revolution.

Another Natco drilling machine is used to drill the smaller bolt holes in the cylinder head. A simple jig plate is used for this operation and is held in line on the cylinder head by means of dowel pins which fit into some of the holes previously drilled.

### Drilling Gear-Case Covers

The gear-case cover *A*, Fig. 12, has 12 holes drilled in its rim at one setting in the jig. It is clamped to the under face of the drill jig *B* and firmly held up into place by means of a bolt and a wing nut.

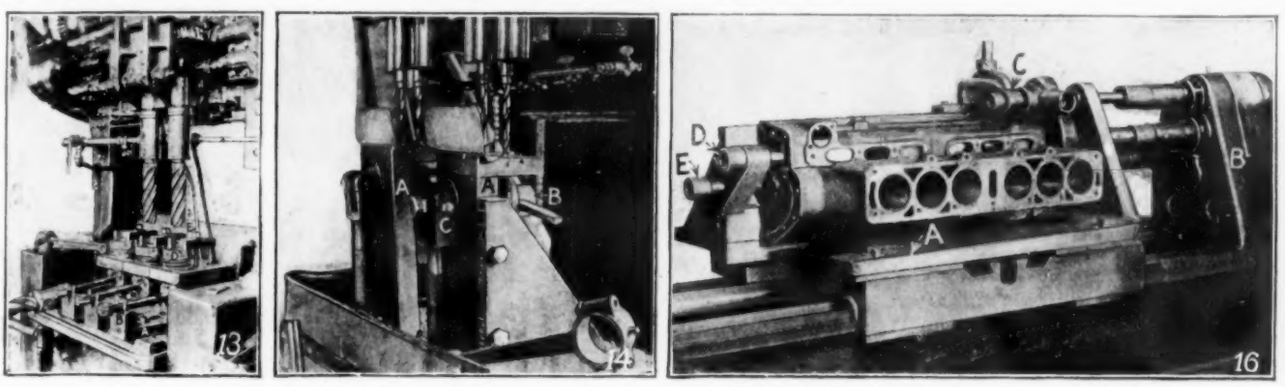
The large ends of the connecting-rods are bored in the Foote-Burt drilling machine, Fig. 13, which customarily uses four spindles on this job. At the time this photograph was taken the machine was set up for some special work so that only two spindles and three jigs were in position. In regular production the four spindles are so set up that two drills are used for rough-boring and two for finish-boring. Three lip drills are used for making this cut and are furnished with a liberal flow of coolant. The main bodies of the drill jigs *A* have pins at their outer ends *B*, which serve as guides for the small end of the connecting-rod. At the point *C* is a three-pronged bearing, upon which the large end of the forging rests to provide ample space for chip clearance.

Very heavy bushings *D* have been provided for the double purpose of guiding the drill and acting as a clamp for holding the connecting-rod forgings in place. The clamping is done by tightening down on the bolt *E* of the clamp *F* until the bushing has been forced down tightly on the top of the forging. Springs are provided beneath the bushing heads, which serve to raise them when the clamp is removed and thus release the forgings.

In the standard connecting-rod the two bolt holes for attaching caps are simultaneously drilled on the Moline drilling machine, Fig. 14. The jig *A* has been provided in duplicate so that two connecting-rods may be drilled at a time. The connecting-rod is held on a tight spindle *B*, which passes through the previously drilled end, and is drawn up against the frame of the jig by the hand screw *C* on the front face, while the lower end is lined up by two dowel pins.

After the caps have been sawed from the large ends of the connecting-rods they are taken to a Victor casting machine, Fig. 15, where they are babbitt lined, the lining being secured in place by anchor holes drilled in both halves of the bearing. The cap *A* and rod *B* are shown after the babbitt lining has been cast and show the oil grooves which are cast in them.

In casting, the connecting-rod is placed about in the position *C* with the cap in place on the large end, a central mandrel passing through the bearing. By raising the handle *D* the cam *E* causes the levers *F* on each side of the machine to close the ends of the mold around the mandrel. The metal, which is melted in the rear part of the base of the machine, is squirted into the opening about the mandrel under heavy pressure.




FIGS. 13, 14 AND 16. BORING, DRILLING AND REAMING OPERATIONS
Fig. 13—Boring connecting-rods. Fig. 14—Drilling for cap bolts. Fig. 16—Reaming crankcase bearings.

All of the bearings of the crankshaft and camshaft are in the base-block casting and are reamed by a triple-spindle line-reaming device improvised from a heavy lathe. The fixture *A*, Fig. 16, fits on the carriage of the lathe and carries the block casting as indicated. A geared head *B* has been provided for driving the three spindles which carry the reamers. These spindles are supported at their outer ends by the three bearings *C*, *D* and *E*, which assure correct alignment and support. The operator standing in front of the lathe feeds the carriage against the reamers until they have passed through the bearings. One of the reamers used for this purpose is shown at *A*, Fig. 17.

### The Washing Machine

After all machine work has been completed on the cylinder block, it receives a thorough washing in a soda solution to remove the cutting grease and make sure no particles of steel or chips remain that might cause damage to the motor after assembly. The apparatus used for this purpose, Fig. 18, is the large hooded structure in the background. The pieces *A* are started at one end, and by a chain conveyor are carried through this structure very slowly, during which they are sprayed with a strong solution of caustic that removes all oil and dirt; they finally receive a washing with clear water to put them in good shape for assembly. Since both the caustic solution and washing water are

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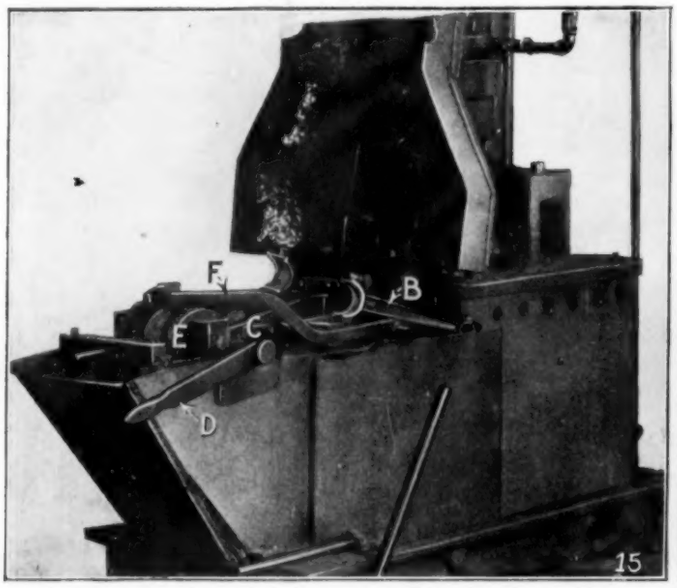
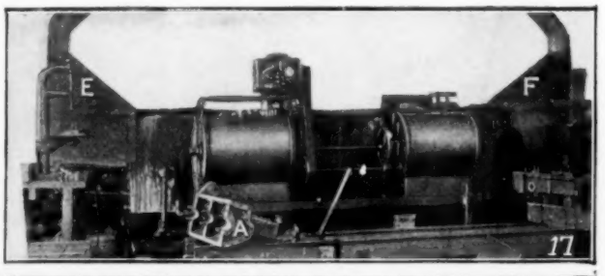
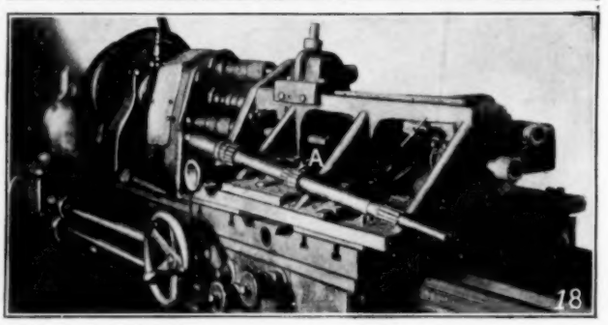
very hot the hoods *E* and *F* have been provided at the ends to carry away the escaping steam.

After complete assembly the engines are placed on the testing block shown in the headpiece and there driven by shaft and chain drive from the large electric motor in the foreground until all bearings and working parts have been given a thorough test of some hours' duration to insure that all operating parts of the motor




FIGS. 15, 17 AND 18. BABBITTING, BEAMING AND WASHING
Fig. 15—Babbitting connecting-rods. Fig. 17—Apparatus for washing motor parts. Fig. 18—Reaming crankcases (showing one of the reamers).

are in good working order before it is taken to the final testing block. In the final test they are run for several hours under their own power to insure against trouble when sent out into actual service.

## Production of Airplanes in England

According to the estimate of the British Advisory Committee of he Ministry of Reconstruction the existing airplane factories in England are capable of the production of 40,000 airplanes and 30,000 motors a year and are able to supply spare parts for an air force of that size.

## Operation Cost of Motor Trucks

At a recent meeting of the Motor Truck Association of America, the operation cost of motor trucks was discussed to determine a proper cost-accounting system. As a basis for this determination, one of the largest operators of trucks has submitted the cost of operation for a five-ton truck which makes 50 miles per day and works 300 days in the year. The total cost per day operated was found to be $29.22. Average operation conditions as to the load were used in compiling this figure. Up to the present time these have equaled a full load one way, or for a 50-mile day transportation of 125 ton-miles at about 24c. per ton-mile. These are actual costs, no profit being included to cover risks, etc. These figures, as given, apply particularly to operation of trucks in large fleets.

## The General-Purpose Tractor

A new type of tractor was recently placed on the market by the Allis-Chalmers Co., Milwaukee, Wis., called the "General Purpose Tractor." This tractor is rated at 6.12 hp., being of the two-wheel type, balanced in the rear by a truck wheel, which is removed in pulling certain machines. The tractor has a normal drawbar pull of 1000 lb. at a speed of 2½ m.p.h. The power plant consists of a four-cylinder L-head type engine, with cylinders cast en bloc, the head being removable, and with a bore of 3¼ in. and a stroke of 4½ in. It weighs 325 lb. and is equipped with a centrifugal governor. It has the splash lubrication system and is equipped with a Kingston ¾-in. carburetor, an Eisemann high-tension magneto and a Bennett dry air cleaner. The power is transmitted through a Bork and Beck dry plate clutch, sliding gear transmission, roller pinion and bull gear final drive. The transmission is lubricated by a geared pump mounted in the transmission case and directly connected with the sliding gear shaft, so that when the tractor moves oil is circulated through the case.

## Altitude Adjustment Device for Airplanes Invented

An altitude adjustment device for airplane motors has been invented by a French engineer, Auguste Rateau. This consists of an arrangement by which the exhaust from the engine drives a small turbine which compresses air drawn into the engine to normal pressure, so that the engine develops full power no matter what altitude. It is claimed that a heavy day bombing machine whose speed at 15,000 ft. ordinarily did not exceed 80 miles an hour, made 140 miles per hour when fitted with M. Mateau's invention.

# Problems of Our Foreign Trade*

By G. A. O'REILLY

FOREIGN trade as we find it treated ordinarily nowadays forms an almost ideal subject for discussion, that is, at least from the viewpoint of speakers upon this subject. Nobody seems to know enough about it to represent serious danger to anything anybody else may wish to say. The next speaker always may assume rather safely that nothing has been said by the last speaker which will disturb or interfere with any comfortable theory which it may be considered expedient or desirable to propound. Nearly everybody who touches the subject talks about foreign-trade problems, outlines problems, defines problems, shows problems against a proper background, calls attention to the dire things that will happen if these problems are not solved, and then, just not to be guilty of the sin of consistency, does not solve these problems, treating the whole matter as though the solution was to come later on, and in a different connection.

*With the exception of those engaged solely in export trade, very few know much about its details. As a nation we have in the past occupied, comparatively speaking, a back seat in the export game, and the reasons are not hard to find. Many manufacturers have sent representatives to foreign countries who not only could not speak the language but were not familiar with the trade conditions existing in those countries. We have tried to sell the foreigner goods made to our own standard specifications, giving little or no thought to the requirements of the purchaser. We were not prepared with foreign banking facilities that would permit giving the long credits customary in some countries. Our drastic shipping laws are such as to make prohibitive the carrying of ocean freight in American bottoms in competition with ships of foreign registry.*

But the subject of foreign trade itself is serious enough and the problems it suggests difficult enough to demand our best and most serious efforts in their treatment. Speakers may find it simple and easy to interest audiences who wish to hear about foreign trade, and writers may find excellent space for their efforts outlining foreign-trade problems, even without solution, but the foreign-trade question itself—the big problem—in our commercial relations with other countries not only has not been solved, but, it sometimes appears, has not yet been even fairly well outlined.

For a number of years our national life has been an exceedingly satisfactory one. We have developed institutions of our own, a few of them almost exclusively ours. We have quite properly abandoned our ancient position of "splendid isolation"—we have definitely accepted the fact that we must learn far more about other nations and other peoples and their institutions than we have known in the past; but through it all we have preserved a national individuality. We even went into this great world war in a spirit differing, we believe, from that which characterized the attitude of any other nation entering; and we believe, too, that we have come out of it with a few things at least not possessed by nations generally.

And now, in the face of all this, a danger presents itself—one which, if developed, is certain to seriously and unfavorably affect our national possibilities in the field of foreign trade. We had hoped, many of us who observed the splendid conduct of our soldiers and our people in the war, that we might emerge with a nationality which would be bigger and stronger and more effective for our own purposes, and for those of the rest of the world too, than any we had known in the past. In spite of this, we find ourselves engaging in such a wild rush for what we call internationality, that we are in danger of sacrificing, in the interest of the new thing, qualities of nationality which represent the strongest possibilities in the life of our country. That this danger touches our foreign-trade possibilities goes almost without saying.

Another problem, a serious one, too, comes to us in the form of a strongly developed tendency on the part of our people to read into the people of other countries qualities and characteristics peculiarly our own. Take gratitude, for instance—the gratitude of our friends abroad, because of the splendid part we have played in the war. Many of our people actually take the possibility of such gratitude seriously—believe that it will bear importantly upon our future success in foreign trade—expect the people of France and Belgium and England and Italy and the other nations with which we have been associated in the winning of the war actually to mix sentiment with business, and to give us preferential treatment in purely business matters, simply because they and we happen to have agreed upon the soundness of a particular great principle controlling men and nations. In other words, many of us are disposed to expect reward in the form of gratitude from these nations simply because we have done something which it was our obvious duty to do—because we have participated in a war which was just as much our war as it was theirs.

Or course, the nature of our participation in the war has been such as to confer upon us rather distinct advantages, even material advantages, which, if we are fortunate, will be utilized effectively in our foreign trade of the future. We now possess that which before the war was not generally conceded to us by other nations, that is, background. From now on, if we do not throw away the gifts which have come to us, the mere fact of being an American, of possessing an American representation, of having an American nation back of us, will be well worth while, even in ordinary everyday business. The best way to gain clear understanding of what this means is to try to imagine the position of the German commercial representative in his foreign-trade contact of the future. It is possible to imagine the time when hatred, disgust, and a desire to punish will pass from the hearts of men, but when can we expect that time when men will trust German honesty, German veracity, German consistency, as they trusted these things before the war? Merchandise will continue to be sold in the competitive markets of the world, largely upon a basis of quality and price.

Another of the important problems we must consider in the foreign-trade connection concerns our national financial situation. At last we have unloaded the responsibilities of a debtor nation and have taken on the not less serious responsibilities of a creditor nation. We got along very successfully under the old burdens and responsibilities—how shall we get along under the new? In the old situation the initiative was largely in the hands of the other fellow—our creditor—and it was necessary only that we comply with the reasonable requirements of the relationship; satisfy him as to our financial soundness and integrity, and work to the end that in time the obligation would be liquidated. Now the initiative is with us, as well as the responsibility of getting our world financial relations upon a proper basis.

The bearing of this question upon the future of our foreign trade is very important and most intimate. Whether or not the world money center of today is located in London or in New York does not matter particularly. We have the gold, the credit and the industrial and commercial health and vigor which mark financial responsibilities toward other nations which cannot be overlooked. If in the

*From an address before the Editorial Conference of the New York Business Publishers' Association in New York City, April 11, 1919.

future our world trade attitude leaves out of consideration the importance not only of being able to meet our own obligations, but also of making it possible for the other fellow, our customer, to meet his obligations to us, we shall find ourselves doing rather scant justice to our own foreign-trade possibilities. Of course, we cannot consistently give this other fellow, from whatever nation, all he wants, or may request.

In what we have referred to as our "big problem" in the foreign-trade connection, that is, ourselves, the question of national point of view appears conspicuously. Our outlook upon the entire field of foreign trade must undergo change. Trade with the world must be brought into the class of national institutions, national necessities. We must come to realize that, from whatever cause or causes, we are in foreign trade definitely and without the possibility of getting out of it. We were committed to this theory before the war, and conditions which have been produced by the war make the conclusion irresistible.

There is no good reason why our sales representative, or investigator, should become expatriate—should lose any portion of the privilege of Americanism merely because he crosses our frontiers and extends his activities into foreign fields. There is no reason why, assuming an intelligent attitude here at home, there should not be American "spheres of influence" in Latin America, and India, and China, and other fields in which our poorer world interests lie. These "spheres of influence" need take on no political color of any kind—they simply will form atmospheres which will be congenial to Americans who find it desirable to do business in these fields, and to the spirit of Americanism as we find it here in our own country.

These "spheres of influence" do not exist at present anywhere outside the United States, not because the people of the different countries concerned have any slightest objection to their development, but because we, good Americans, in the United States have not yet come to recognize the importance of a congenial atmosphere for those we send abroad to do our work and sell our goods. England and France and Germany and the other countries which have found foreign trade profitable have made no such mistake as this. They have gone into foreign lands fully nationalized, backed up by a national spirit which was definite and tangible; their commercial backbone, no matter what else it contained, was at least 80 per cent. British or French or German or whatever other national spirit was represented.

### Necessity for Government Aid

In the development of this new national spirit not only must be included those of us who sell and those of us who manufacture for sale, but all other expressions of activity, not perhaps directly bearing upon foreign trade but in one way or another included in its support, or interested in its success. Most important of all, perhaps, government must be included. How futile it must appear for any government to talk about its interest in foreign trade, and about the facilities it is providing in the interest of foreign trade, while there remain in existence laws which make it impossible for American ships to carry merchandise to the markets of the world in competition with the ships of other nations.

There are those, not so many now as formerly, who believe that our great problem in foreign trade is salesmanship. This may be true, but only in the sense that one of our greatest problems in domestic trade also is the problem of salesmanship. Salesmen, like any other class of men, can be divided into good, bad and indifferent. If we keep the good ones at home and send the bad or indifferent ones abroad, we certainly shall encounter a serious salesmanship problem in our foreign efforts. Or, if we reverse this process and keep the bad ones here at home, we are sure to discover unexpected weaknesses in our domestic commercial situation.

If, in trying to secure an advantage in a particular foreign market we indulge in the very bad habit of "sending a boy to do a man's work" we must not expect best results. The representative of the New York concern who goes to Tokio, or Singapore, or Buenos Aires, in the hope of interesting the business men of these places in his wares, must be careful to avoid shocking sensibilities and disturbing existing conditions which the people of these countries take seriously. He must be prepared to encounter and understand new points of view quite different from those which are very common in good old New York. In other words he must "watch his step," and watch it continually.

### Distance in Points of View

It is a long, long cry from commercial Boston, say, to commercial Singapore, Buenos Aires, if considered in terms of difference in points of view, but when we speak of points of view, we must realize that Boston, and Ipswich, South Dakota, or New York and Portland, Oregon, are not near neighbors after all, and there are New Yorkers who consider Newark, N. J., a long way off.

So why worry? Why try to make ourselves believe that the field of foreign trade presents nothing but new problems? Why not try to convince ourselves that in our domestic commercial experience we have been proceeding along sound lines; have had opportunity to deal with industrial and commercial fundamentals? And then, why not apply our experience in this domestic field to the very much over-estimated difficulties which must be encountered abroad? And, above all, why send a boy; why not attack this supposedly difficult foreign situation with the very best we have; the best that is in us?

If we do this we will find that the foreign-trade problem is not so terribly difficult after all. If we manufacture specifically for a foreign demand, as we do for domestic customers; if we find out what the foreign customer wants, and give it to him as he wants it and when he wants it, just as we do in the domestic field, and if, when confronted by a stiff salesmanship problem, as we are in the foreign field, we send abroad the best salesman instead of the ordinary or poor ones, again following our domestic plan of treating difficult sales situations, there is no reason why we should not succeed.

Of course, if this theory is to be carried out in a practical way we must eliminate certain tendencies at present appearing in our foreign-trade plans. These tendencies are not noticeable in the plans of those of us who are in foreign trade seriously; nor in the plans of those who have had opportunity to study foreign trade in a practical way, but in the plans of those who have gone into overseas trading, either with insufficient equipment, or in a spirit which does not include the elements we are accustomed to expect in substantial, commercial enterprise, foreign or domestic.

The most undesirable form assumed by these tendencies is a disposition to force our goods, our ideas, and our points of view upon the foreigner by a process practically of main strength. It is for instance assumed that a particular style of shoe, or fabric, or piece of machinery, or business method is good and sound, and hence should be acceptable to any man of sense and business judgment. It may be that in pursuing this dangerous policy we have been so impressed with the merit of our product that we have hoped in time that the foreign customers would come to see the product as we saw it.

Fortunately this tendency among manufacturers and salesmen has received a serious check in recent times. It is coming to us gradually that it is the other fellow's judgment, and not ours, that must control in the selection of what he purchases. We are rapidly approaching the conclusion that if we are not willing to play the foreign-sales game on a basis agreeable to the foreign customer and understandable by him, we are playing the wrong game and had better abandon the foreign field and stay right here at home where the difficulties incident to a getting together between manufacturers and consumers are not so serious as they are abroad.

So much for the gloomy side of the foreign-trade situation, the problem side. Now, what of the future? What possibilities and attractions does it hold out to us? Our present foreign trade in volume is quite satisfactory, or at least was until a very few weeks ago, but when peace after war, actual peace, becomes an established fact, and after the nations of the world, our competitors, get squared away again for action and competition, what then? How much of the war-conferred benefit we now enjoy will remain with us? Can we hold our present trade? Can we produce at a price which will enable us to compete with

the nations which, for many years, have been able to operate on a wage scale much lower than ours? Will the increase in our wage scale which has resulted from the war be met by a corresponding increase in scales of wages in competitor countries? Will the part we have played in the war help materially in our trade relations? Will the fact of our world supremacy in money matters give us an advantage which will continue?

These are the questions which are being discussed most seriously at the present time. And, on the whole, the situation, that is, the prospect for the future, seems at least hopeful. Some features of the case clearly are in our favor. For instance, because during the war we have fed the armies of the world, it is nearly certain that American food products in the future will enjoy a degree of popularity outside the United States which they did not enjoy in the past. Soldiers returning from the battlefields of Europe tell many and interesting stories about the experience of foreigners with our foods, and describe an entirely new attitude abroad toward Boston baked beans and brown bread, for instance, and a number of other institutions well known to the American table, but until the experience of the war practically unknown in many other countries. Another fact sure to be found to our advantage is that as the result of the increased purchasing power of the average individual in other lands he is now able to take a much greater interest in what we call "quality" in goods than was practicable for him in pre-war times. Then, he was obliged to buy cheap goods; now, he is able to buy goods of a much better quality. In former years the cheaply produced, low-grade articles manufactured in Germany possessed a distinct advantage over the more expensive, better American article, because it more nearly harmonized with the financial condition of the South American, or Far Eastern, or Scandinavian purchaser, than did the American article.

Another advantage which has come to us through the war is to be found in the lessons we have learned. Our point of view has been broadened; our national commercial horizon extended. We have learned much concerning world business which, before the war, we did not know. Our banking situation has improved wonderfully, both at home and abroad. The processes of foreign exchange no longer are shrouded in deep mystery, but are things with which a great number of American banks have acquired substantial familiarity. The problems of foreign finance, too, have been put on the high road to solution. One cannot read English financial publications or reports issued by important British financial institutions without being struck by the very substantial respect these people have developed for certain qualities we possess in the field of world finance.

And we are learning everywhere, and shall continue to learn. We find ourselves rather effectively emancipated from many of the fictions which in the past tended to confine our study and investigation to things domestic. Our nation is sound, vigorous, possesses practically unlimited wealth and credit, has become definitely established among the nations, not as a youngster seeking for recognition, but as a seasoned veteran, possessing national qualities which demand respect and inspire confidence.

We still have our problems to solve, of course, but who, realizing the miracles of accomplishment to our credit as the result of our part in the war, can have any reasonable doubt as to our ability to solve them? We cannot afford to play with the situation, or to sleep upon our opportunities. The case is altogether too serious for that. Before launching our plans we must take stock carefully; must measure our world assets with reasonable accuracy; must not over-estimate our advantages, or underestimate the advantages possessed by our world competitiors. Gratitude and brotherly love and world citizenship and internationality all must be given their proper place in our plans for the future, but no one of them must be exalted beyond its rightful place in our own United States world plans.

We must avoid mixing things up unnecessarily. Business and sentiment generally must be kept apart. If world gratitude is to be ours we will be that much ahead; if world charity is to be ours to dispense, let us dispense it intelligently, and upon plans of our own, not upon those prepared for us by other nations.

# Industrial Co-operation*

By CHARLES P. STEINMETZ

*Capital and labor are equally essential to industry. While the interests of employer and employee are opposed at some points they are identical at others. To bring about an ideal condition in industry it is necessary to merge as far as possible the two interests in one. It has taken two generations to bring about the unfortunate situation wherein it seems that fighting is the only way to settle the differences. We can only get back to a saner basis by working along these lines; merely wishing for, or talking about it will accomplish nothing.*

THERE is an old saying, "In unity lies strength and a house divided against itself must fall." If that is true of anything it is true in Mother Industry and particularly true today where modern civilization in the world's war has practically become bankrupt and we now, as receivers, have to reorganize the world again. Our industries must have coöperation to be successful and efficient; to be able to take care of the world's work as it has to be done to redeem our civilization from what has occurred in the last few years. But is it possible?

The socialistic radical labor agitator tells us there can be no peace between capital and labor. They are inherently antagonistic and must fight to a finish because the interests of one are against the interests of the other. In industrial depression the employer as well as employee suffer. The old-time corporation president preaches to us that capital and labor interests are identical; that if the individual interests are trusted to his keeping that they will be taken care of. At the same time every child sees and knows that a dollar more paid out in wages means a dollar less profit and that the interests of capital and labor are different—entirely opposite in some respects. We cannot get any further in solving the problem if we take an extreme view one way or the other. Capital and labor interests are not identical but are the same in some respects and opposite in others. In general, in any industry, those interests which have to do with industry on the outside, customers, etc., are usually identical.

Within the industry the interests of employer and employee are often opposite to each other. There are relations in which capital and labor interests are identical and some in which they are not identical, but there are many other relations in our modern civilization where there are common interests and unidentical interests. Take buyer and seller, manufacturer and customer, landowner and renter. Many interests in common, and still we do not have warfare. They are not going to fight merely because there are some features where the interests are opposite. In all those relations where the relations exist as between employer and employee, there is no settlement of the condition by fight and warfare; but on the contrary there are often, usually very often, friendly relations between the manufacturer and customer. It is not the historical relation, as we unfortunately find, in this one feature. Why is it necessary that employer and employees and capital and labor cannot get along in the same manner by coöperation? The reason is historical.

*An address before the Industrial Conference of the New York Business Publishers Association, April 11, 1919.

Originally, the employer and employee bore an equal standing as regarding industrial power, in the days of small manufacture. The organization of employers as represented by the formation of industrial corporations meant an increased power on the side of the employer and a disadvantage to the employee, until labor organizations were formed; but conditions had already become hostile.

How to bring the coöperation about; how to return to such conditions as should have remained operative, is the main problem, because we must bring about coöperation within our industry if we wish to meet the demands of the new world. It has taken two generations of development to bring about the present unfortunate situation where differences are settled by fighting. We cannot expect to secure this coöperation by merely wishing, or talking about it. It is a long, slow, difficult work which will mean many setbacks and we have to remain at it and fight for it.

### Each Side Equally Responsible

Adjustment must come first from the employers, but not for any moral reason. The present situation is not the fault of labor more than capital. It is merely historical development of a situation beyond the control of man. The employer must have a broader view than the employee. We must not forget that there are still many imperfections in our civilization. Most serious is that a large majority of men cannot enjoy complete education, as would be desirable for making the most of themselves, and heads of industry as a rule have the benefit of the broader education and must take the broader view of things. We cannot expect the same broad view of the one who left school at fourteen years of age as the one who has enjoyed a more extensive education. That the initiative must come from capital is realized. All through groups of occupations and industries we have talk on coöperation. We must realize it does not mean to spend a few dollars here and there, but the work is probably the most important development in the industrial field which faces us today and men must devote their time and attention to it, and must give high-grade service, the same as those in charge of other administrations. We cannot expect to see any positive results until we are really willing to approach it more seriously in time, interest, quality of men and amounts of money devoted to bringing about industrial coöperation.

Coöperation implies two parties working together, not one settling the matter and telling the other you must do that and that and then we will coöperate. Unfortunately most of the serious efforts made in this direction have been of that character—that the employer has worked out plans and then asked the employees to coöperate on those plans. Very often those plans were good and the whole scheme would have been satisfactory if it could have been worked out jointly, but it came as paternalism and was therefore tainted from the beginning. That is not coöperation.

It is easy to say we must have coöperation; also to find fault. It is not easy to make suggestions how it should be done and how the present strained relations between capital and labor should be overcome. Probably there is no single way to bring about true coöperation. It depends largely on local conditions and social conditions. In short, there is not a broad and single way. Before we try to find out let us discover the relation of Mother Industry. One attitude, the attitude of the old-time employer, is that industry is the private property of the owner, recognizing only capital and not labor. This relation was destroyed forever at the moment when President Roosevelt interfered in the anthracite coal trouble and brought both sides to terms. The other extreme is the socialistic conception that all wealth is created by labor and that all wealth therefore belongs to labor and that capital is a parasite on labor due to having acquired a monopoly of the means of production. At present industrial production requires capital and labor. Both are necessary. Labor unrest is a demand for a share of the profits of industry and a share in the management of industry. This is the final foundation of all our social unrest. Since they are both necessary it is right that they both demand a right in the share of the profits and management of industry. There are several ways—mostly unsuccessful. One way, welfare work, which is important and useful, but offensive and insulting, by being forced on labor in a paternalistic manner, is appreciated only when not done as a welfare work but merely as a matter of corporate self-interest. We must realize that quality of one's work depends on conditions under which work is done. That makes the difference in the self-respect and quality of the man. This will not bring about coöperation. We must not use the name "welfare work." It should be called an industrial relation department or committee, instead of welfare department.

Another attempt which has been made is the attempt of getting closer relation by the bonus system, giving bonuses during times of industrial prosperity and getting the employee interested in the industry. To some extent that is all right. Somewhat of paternalism. It may be all right in Germany where people have been trained to look up to their masters as superiors, but leaves a bad taste among Americans. They are prone to ask, "Why not give us an increase of wages instead of a bonus?" The bonus system has the disadvantage of sharing only in profit and not in management.

Another attempt is the committee system, claimed to have been successful in England. There are several forms. There are the committees elected by employees which take up with employers all relations of mutual importance and interest, arbitrating wages, hours, etc. Another form is joint committee, half of which is elected by employees and half by the corporation. This appears to have very much in its favor. There are, however, some difficulties; the most serious of which is that labor has its own organization and such action is apt to be taken by labor unions as not recognizing them. Labor unions claim that they represent the employees. Facts show in many cases that they are right, because while union men may often have a minority among employees, when serious questions arise, experience very often shows that the majority of non-union workers take the lead of the unions rather than the non-union committees. Shop committees are liable to be considered as eliminating the labor unions by putting up a rival union. While leaders of industry recognize the necessity of coöperation, unions of labor organizations have not yet realized the advisability of coöperation in industry. But there is another side. Do we want the committee system? Let us assume it is successful—a board of directors on one side and a labor committee on the other. Is this not another warfare by organizing two different parties?

The last is wage dividend. Mother Industry requires capital and labor. Therefore both are entitled to share in the profits. Capital is entitled to a fair rate of interest on the money invested and labor is entitled to a fair rate of wages for the work done. All profits beyond that belong to capital and labor. These should be divided as dividends, being dividends on capital stock, the other being divided on labor stock as found by yearly wages. This system is in operation in a number of corporations, in electric-utilities companies and others. It lacks provision for share in the management. But we could carry it further and recognize labor as equivalent to capital and give the labor stockholder the same right as the capital stockholder in the management. This would be revolutionary, but both would share in the profits, getting dividends, one on capital and the other by labor stock. Both share in the management (labor-union officials could hold the proxies). This does not set up rival administration, but brings about joint control by evolution and not by revolution. The question is, How far should employees be recognized as stockholders? Should every one, even if he joined yesterday, vote today? There are many things that show that only those who have been with the organization for a number of years should be recognized as wage stockholders, taking part in dividends and management. We could set the limit at ten years. There would not be many and would not make any radical change in industry, and every year or so we could change the minimum, going down to six or five years. This would eliminiate any opposition except from the extreme socialists.

Finally, leave only the laboring men as stockholders. This revolution could be brought about by evolution if desired. This would be carried to full socialization of society by evolution, as the final outcome of our industrial development. We all believe we want to bring about this change by evolution and not by revolution.

US ARMY ORDNANCE NEWS

# Manufacturing the 9.2-In. Howitzer Shell—II

By S. A. HAND
Associate Editor *American Machinist*

*This installment covers operations on the shell from finish-turning the outside until it is ready for fitting the base plug in place. At this point the operations are interrupted to describe the making of the base plug. This will be considered as an integral part of the shell in the further descriptions which will appear in the next article.*

UPON the completion of finish-turning the outside of the shell the next operation is to score, undercut, turn the groove for the copper band and form the base radius. This is done in a 26-in. lathe and the shell is held by the interior on a short expanding mandrel with four wide blades similar to that used for finish-turning. The tools for this operation are held in a square turret on the lathe carriage; three of them are forming tools of high-speed steel and one is a square Stellite tool in a holder. Fig. 16 shows the tool layout. First, the position of the band is marked with the scoring tool, then the Stellite tool is used to turn the band groove to the diameter of the top of the wave lands. The scoring tool is again used to score the ends of the band groove to the diameter of the roots of the wave lands, after which the undercutting tool is fed in to the same depth and moved sidewise in both directions to make the groove the proper width and to undercut or dovetail the sides to an angle of 7½ deg. The last operation is to form the radius on the base. The sinusoidal waves are cut in a 26-in. lathe, the shell being held on an expanding mandrel provided with six buttons, three near the front and three near the back. The buttons (which are equidistantly spaced circumferentially) are normally pressed inwardly by flat springs and are expanded by the longitudinal movement of a tapered plug controlled by a handwheel at the left of the headstock.

The reciprocating motion of the carriage necessary to produce the waves is controlled by the cam *A*, Fig. 17, which revolves with the spindle of the lathe. The roller *B* is fastened to the carriage and is held against the cam face by a heavy spiral spring under the cover at *C*, which pushes the carriage to the left. Thus motion is transmitted to the carriage in one direction by the cam and in the other direction by the spring.

The waves, seven in number, form an included angle of 70 deg. and are 0.05 in. in height. The tool, made of high-speed steel, is formed so as to cut all the waves at once. It is held in the tool block in the manner shown in the illustration and is fed in bodily by the large handwheel, the top of which may be seen in the lower left-hand corner. Afterward five scores are cut across the waves at an angle of about 45 deg. with a broad chisel. These act as air vents and prevent the trapping of air around the waves as the band is being pressed into place. At this stage the shell is subjected to a preliminary Government inspection. This is a visual inspection for cracks and general condition; it also includes gaging the band groove and waves for all operations.

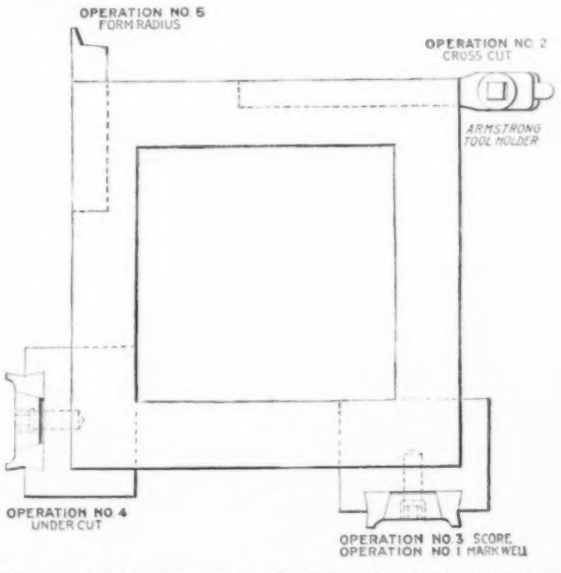



FIG. 16. TOOL SET-UP FOR SCORING, TURNING AND UNDERCUTTING

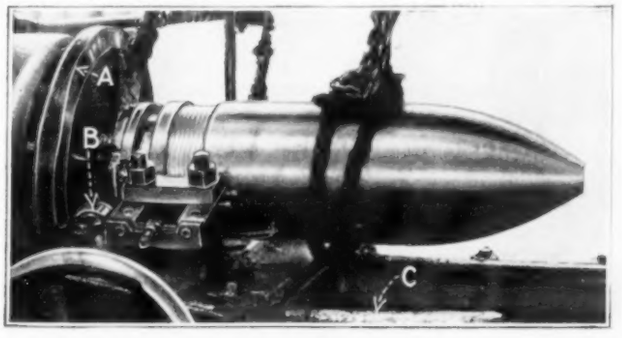



FIG. 17. CUTTING THE WAVES

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Before pressing on the copper band an expanding plug, details of which are shown in Fig. 18, is inserted in the bore at the base and expanded by the use of a long wrench. This is to minimize the collapsing effect of the pressure in banding. All grease is washed from the band groove by dipping in a vat of hot Oakite.

### Pressing on the Copper Band

The copper band is brought to a red heat in an oil-fired muffle furnace and the shell is placed with its base in a depressed seat in a Metalwood six-cylinder banding press of the usual construction, Fig. 19. The hot copper band is dropped over the shell and rests on a shoulder of the shell seat which is of the proper

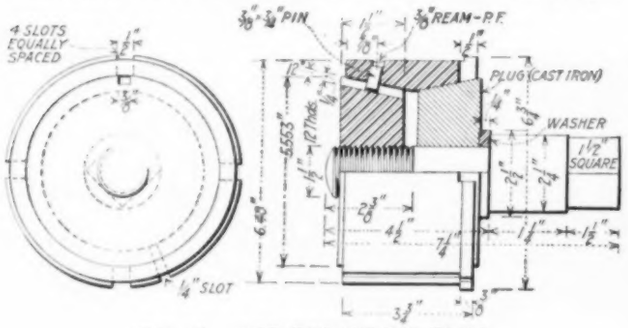
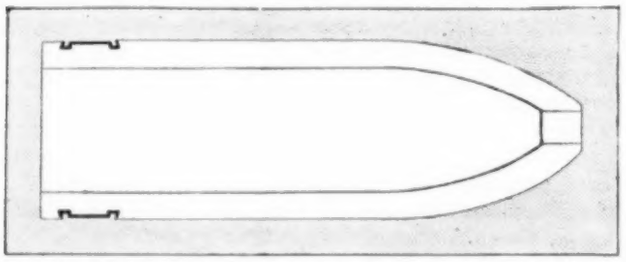



FIG. 18. THE EXPANDING PLUG

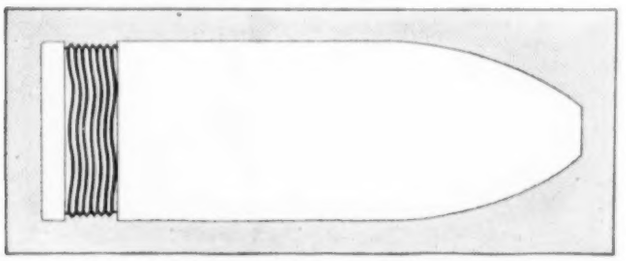
height to bring the band fair with the groove into which it is to be pressed.

The ram heads of the banding press are scored circumferentially in such a way that the greatest pressure



TRANSFORMATION FOR OPERATION 507—SCORE, UNDERCUT AND TURN FOR WAVE

Machine—Fairbanks-Morse 26-in. lathe. Number of Operators—One. Work-holding device—Wrench-operated expanding mandrel with four blades. Tool-holding device—Square turret on carriage. Tools—Stellite for turning; high-speed steel for scoring and undercutting. Number of cuts—One. Cut data—Speed, 52 ft. per minute; feed, 0.046 in. per revolution. Coolant—Soluble oil. Gages—Angle, depth, width, diameter and length from base. Production—65 per machine in eight hours.



TRANSFORMATION FOR OPERATION 508—WAVE

Machine—Fairbanks-Morse 26-in. lathe. Number of operators—One. Work-holding device—Wrench-operated expanding mandrel with six serrated buttons. Cutting tool—High-speed steel. Number of cuts—One. Cut data—Speed, 32 ft. per minute; feed, hand. Coolant—Soluble oil. Special fixtures—Cam on faceplate; roller on carriage held to cam by spring. Gages—Diameter for top of wave lands. Production—225 per machine in eight hours.

is exerted directly over the waves and at the edges where the band must be forced into the dovetailed sides of the groove.

The pressure applied to the cylinder in banding is 2500 lb. by the gage, which is equal to about 20,000 lb. per square inch of band surface. In addition to the pressure exerted by the press there is that of shrinkage as the hot band cools.

In banding, the pressure is applied and released several times, and in the interim the shell is partly

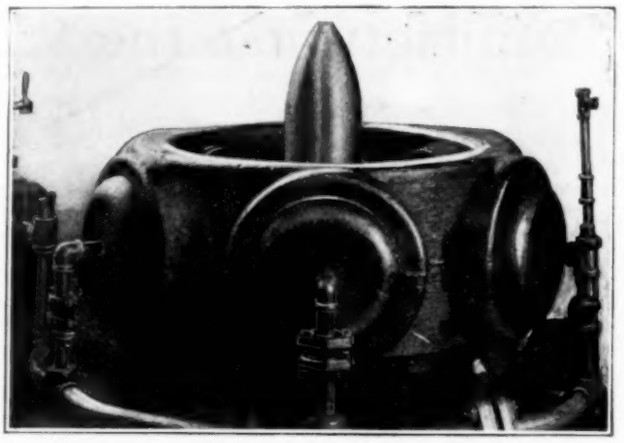
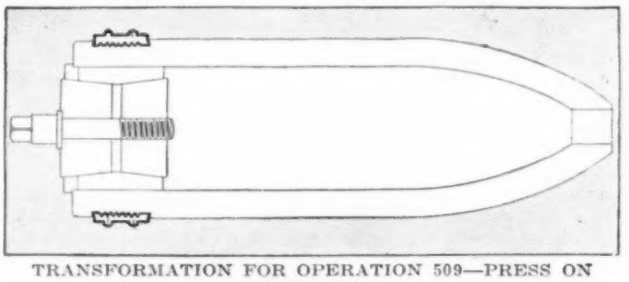


FIG. 19. PRESSING ON THE COPPER BAND

revolved so as to equalize the pressure at all points. The banding operation requires the labor of seven men distributed as follows: Two to put in the expanding plugs, one to wash and put the shell in press, one to heat and put on the bands, one to operate the press, one to remove the shells from the press and one to take out the expanding plugs.

### Reboring

Notwithstanding the use of an expanding plug the banding pressure collapses the shell from 0.015 to 0.020 in. at the location of the band and to a less extent for some distance above and below. This necessitates reboring as far in depth as any reduction has taken



TRANSFORMATION FOR OPERATION 509—PRESS ON COPPER BAND

Machine—Metalwood six-cylinder banding press. Number of operators—One and six helpers. Pressure—2500 lb. on gage = 9 long tons per square inch on band. Special fixtures—Expansion plug for shell base. Production—350 per machine in eight hours.

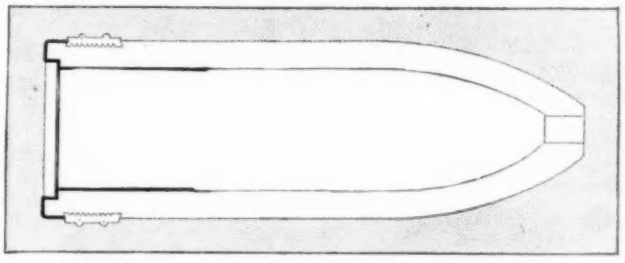
place. This is done in a 22-in. lathe, the shell being held in a long draw-in chuck supported at the outer end in a ring steadyrest. A single-pointed Stellite boring tool is used.

Before removing the shell from the lathe the counterbore for the flange of the base plug is roughed out and the base below the copper band is re-turned to a

# ARMY ORDNANCE NEWS

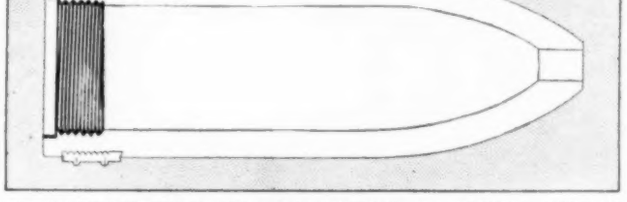
diameter of 9.05 in., the lower edge of the band faced to a definite distance from the base and the base-corner rounded. The reduced diameter provides clearance for any burrs that may be forced back from the copper band by the rifling when fired from the gun.

The thread for the base plug is a left-hand Whitworth thread, eight per inch. It is made left hand so that the sudden spinning of the shell to the right as it takes the twist of the rifling will tend to tighten the plug in its place. Whitworth thread is used because



TRANSFORMATION FOR OPERATION 510—REBORE, ROUGH COUNTERBORE AND ROUND CORNER AT BASE

Machine—Davis 22-in. lathe. Number of operators—One. Work-holding device—Hand-operated draw-in. collet. Tool-holding device—Turret on carriage. Cutting tools—Stellite. Number of cuts—One. Cut data—Speed, 184 ft. per minute; feed, 0.039 in. per revolution. Coolant—Soluble oil. Gages—For bore diameters, plug, go, 6.490 in., no-go, 6.510 in.; rear of band, snap, go, 9.055 in., no-go, 9.045 in.; length from base to band; radius for corner. Production—55 per machine in eight hours.



TRANSFORMATION FOR OPERATION 511—MILL THREAD AND FINISH COUNTERBORE

Machine—Lees-Bradner thread-milling. Number of operators—One. Work-holding device—Hand-operated draw-in collet. Cutting tools—High-speed steel hob and plain milling cutter. Number of cuts—Two, one for thread and one for counterbore. Cut data—Speed, 84 ft. per minute. Coolant—Mineral lard oil. Gages—Plug, Whitworth left-hand thread, 8 per in.; diameter and depth of counterbore. Production—45 per machine in eight hours.

the plant had been previously making the 9.2-in. British shells which required that type of thread. As the plant was already supplied with hobs and gages for the Whitworth thread there was no objection to its use, as the plug becomes an integral part of the shell and is never removed.

*(This Article Will Be Continued in the May 15 Issue.)*

## Abstracts of Recent Office Orders of General Interest

No. 610, Mar. 27. Maj. Parker Dodge is designated a member of the Board of Officers to approve executive salary increases at plants working on a cost plus basis. The present members of the board are as follows: Maj. H. L. Rice, Maj. Arthur Frantzen, Maj. B. T. McCormick, Maj. C. A. Stolberg, Maj. J. S. Black, Maj. Parker Dodge.

No. 611, Mar. 28. Maj. J. L. Crane is designated Chief of the Rochester District Ordnance Office and Chairman of the Rochester District Claims Board, succeeding Mr. Frank S. Noble. Appointment effective Apr. 1.

No. 614, Mar. 31. Col. L. B. Moody is assigned as Chief of the Tank, Tractor and Trailor Division, succeeding Maj. Paul Weeks.

No. 616, Mar. 31. J. H. Scobell is appointed Ordnance District Chief, Cleveland District Ordnance Office and is designated Chairman of the Cleveland District Claims Board, succeeding Samuel Scovil, effective Mar. 27.

No 617, Apr. 2. George J. Roberts, special assistant to the Chief of Ordnance and Deputy Fixed-Nitrogen Administrator, is placed in charge of all matters concerning the fixed-nitrogen interests of the Ordnance Department, with authority to act for the Chief of Ordnance in all such matters—especially in connection with the administration of the Nitrate Division and the present and future disposition of nitrate plants.

No. 618, Apr. 1. A board to consist of the following, Col. Thomas J. Smith, Lieut.-Col. Dwight K. Shurtleff, Lieut.-Col. Russell L. Maxwell, Lieut.-Col. Patrick J. O'Shaunessy, Maj. Amasa Trowbridge, Maj. Frank J. Stephenson, Maj. Michael T. Carney, Maj. Frederick C. Hosea, Capt. F. H. Keller, and First Lieut. Henry L. Slade, is appointed to investigate and determine proper methods of procedure at ordnance establishments in assuming property and financial responsibility for salvage materials transferred to those establishments. This board will meet at Washington, D. C., at such times as may be called by the senior member.

# PERSONALS

Capt. Earle K. Williams, 350 Broadway, New York, who was commissioned First Lieutenant in June, 1917, has been discharged. He attended the University of Pennsylvania and was formerly an executive with S. H. Kress & Co. He has been on duty in the Planning and Control Section of the Engineering Division.

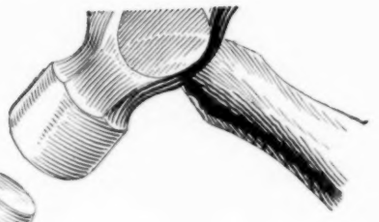
Maj. Frank W. Wood of Cleveland, Ohio, president of the Wood & Spencer Co., machinists and machinery manufacturers, and also president of the Cleveland Castings Pattern Co., has been recently discharged from the service. He served about 11 months in France in the Construction and Maintenance Division.

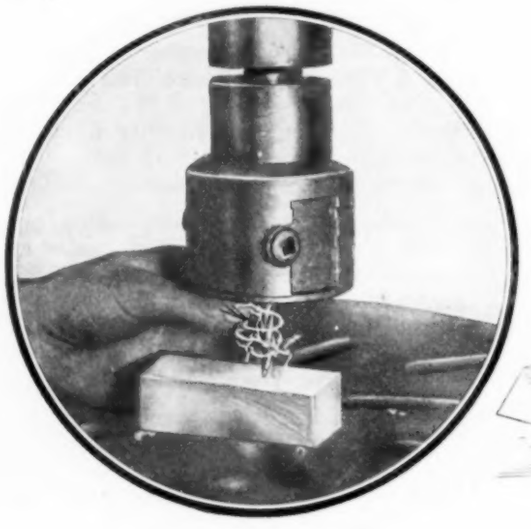
First Lieut. Hudson D. Dravo, whose home is at 4732 Center Ave., Pittsburgh, Penn., was discharged on his return to America after ten months' service with the American Expeditionary Forces. His service overseas was in connection with the construction of railway artillery. Before entering the service he was employed by the Pennsylvania Railroad Company.

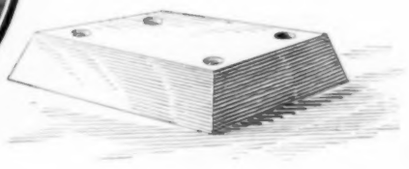
Maj. Carlisle Mason has returned from France, and has resigned his commission. He will resume the practice of general engineering in a consulting capacity under the firm name of Carlisle Mason, Inc., 207 Broadway, N. Y., and will be assisted by a staff of experts in the specialized branches. Major Mason has had 30 years' of varied engineering experience covering a vide field of scientific research both at home and abroad.

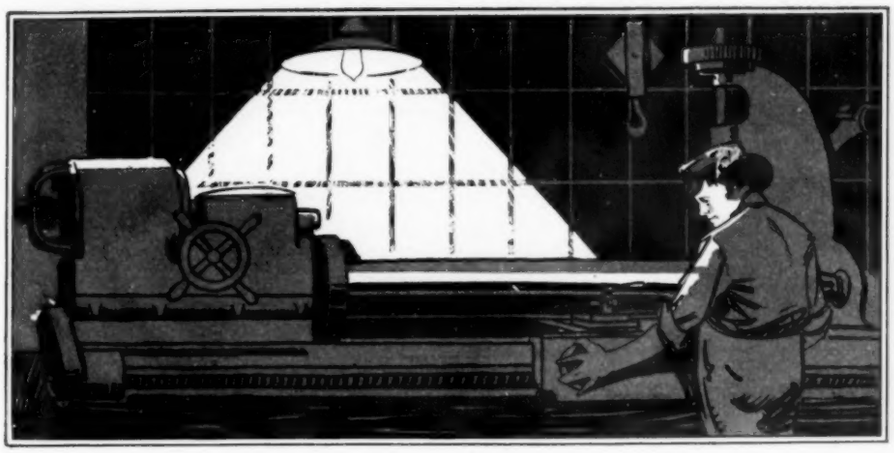
# CURES *for* COMMON SHOP COMPLAINTS

*By J. A. Lucas*









**LIGHT, ELECTRICITY and The Shop**

By C. E. Clewell

# Small Motors for Hand Tools and Others Uses

***The field of electric motors in capacities of fractions of a horsepower is sometimes overlooked. This article takes up the question of small motors for industrial purposes and emphasizes why their use has increased so rapidly in recent years. Included also are illustrations of some types of hand tools with motor equipment.***

THE high efficiency and wide range of usefulness of small electric motors with rated capacities of less than 1 hp. are perhaps not generally recognized, and the object of the following notes is to call attention to a number of their practical uses. The principal reasons advanced for the development of the small electric motors include: (a) The influence of efficiency engineering, which has made the industries realize that time and wages can often be saved by the operation of the smaller appliances by electric power; (b) the fact that it has become possible to use small motor-driven equipment on electric circuits which were originally installed for purposes of lighting only, and (c) the fact that the small motor has proved itself to be a reliable source of mechanical power and has thus led motor manufacturers to make the necessary investments to develop this line of equipment as an important branch of the electric-motor field[1]. Bernard Lester in some of his writings on small motors for power purposes calls attention to what seem to be the principal features that make them so popular for many purposes. First, the small electric motor is a simple device to start and stop; second, its weight is usually so light that together with that of the device driven it is low enough to make them easily portable, and third, small motors can be operated continuously or intermittently over long periods with little or no attention. The average central station from which shops purchase electric current tends to the use of the alternating current for its transmission and distribution circuits. It also often occurs that the lighting and other circuits of the shop, as supplied by the shop power house, are fed by alternating current. It follows therefore that the principal development of the type of motor for these small-power applications has been one that could readily be connected through an ordinary lighting socket or other means to the regular lighting or other circuits, and as the lighting circuit is practically always single phase, when of the alternating-current type, it follows also that most of the attention on the part of the motor designers has been along the lines of a good and reliable single-phase alternating-current motor. In a general way all of the principal single-phase small motors fall under one of the two main classes, in one of which the speed varies widely with the torque which the motor is called upon to deliver, and in the other the speed remains practically constant under all conditions of the load up to the full rated capacity of the motor. The first type, because of its wide speed variation with load changes, has a rather limited field

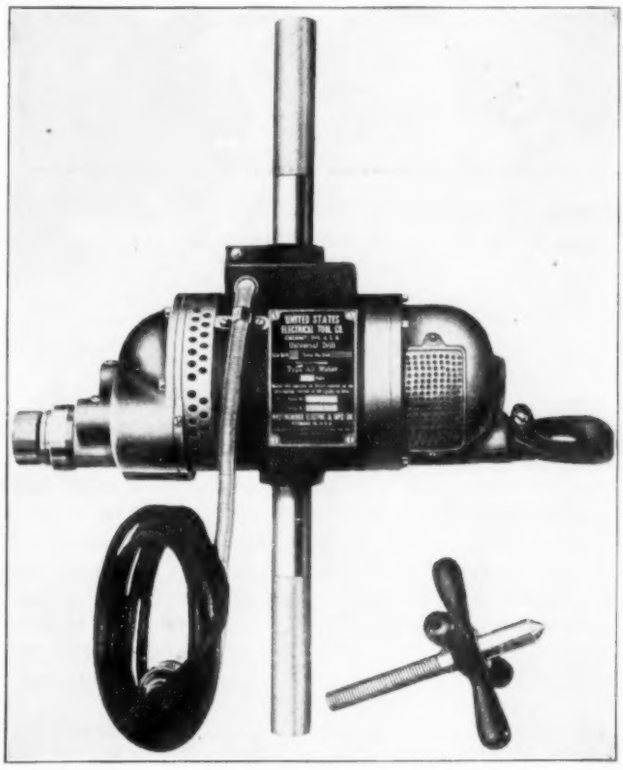


FIG. 1. A MOTOR-DRIVEN DRILL

[1]These causes of development of the small motor field, together with certain points concerning types of small motors, their characteristics and uses are based in part on discussions of Bernard Lester, Trans. Am. Inst. of Elec. Eng., Vol. XXXIV, 1915, p. 681, and "Standard Handbook for Electrical Engineers," p. 1286.

of application, while the second is better suited to the general run of service.

The name given to the first type is the series-wound, single-phase, alternating-current motor, and while its speed characteristics may be a disadvantage in some cases one of its greatest advantages is that it can be used under certain conditions of construction on both direct- and alternating-current circuits having the same voltages, and that when so used the operating characteristics are sufficiently similar, in general, to meet the needs of the driven device. One of the conditions of its use, however, is that it must be mechanically coupled to its load at all times, since motors of this type attain dangerously high speeds if they are operated without load.

The use of the series single-phase motor is largely limited to such industrial cases as fan-type forge blowers, fans for exhaust or supply purposes, and for portable tools where the electric supply is turned off when the tool is not in service, rather than mechanically to disconnect the motor from the tool, thus leaving the motor attached to the supply circuit. In all of these applications, therefore, it is understood that the series motor is permanently connected to its load to avoid the dangerously high speeds above referred to.

### The So-Called Repulsion Type

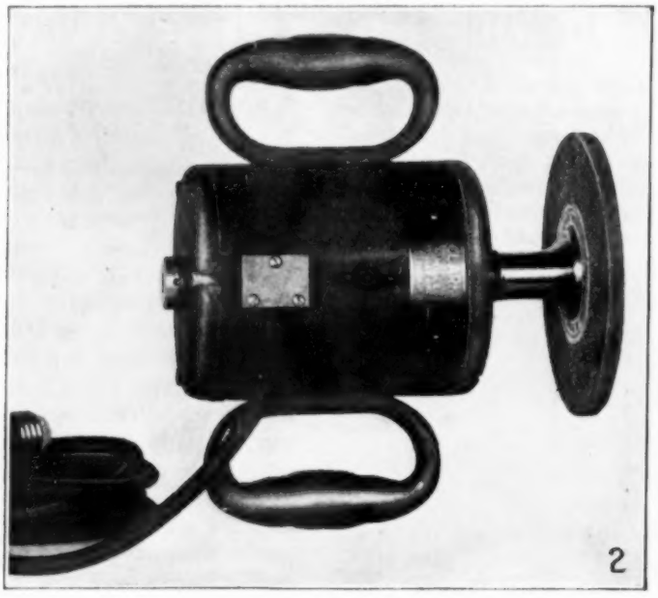
Another alternating-current form of small motor is the so-called repulsion type, which has approximately the same speed-torque characteristics as above outlined for the series alternating-current motor, but which does not reach a dangerously high speed at zero load; that is when the motor is disconnected mechanically from the device with which it is used. While this is an advantage in some cases, this type does not possess the same flexibility of use on both direct- and alternating-current circuits as may be the case with the series-wound type.

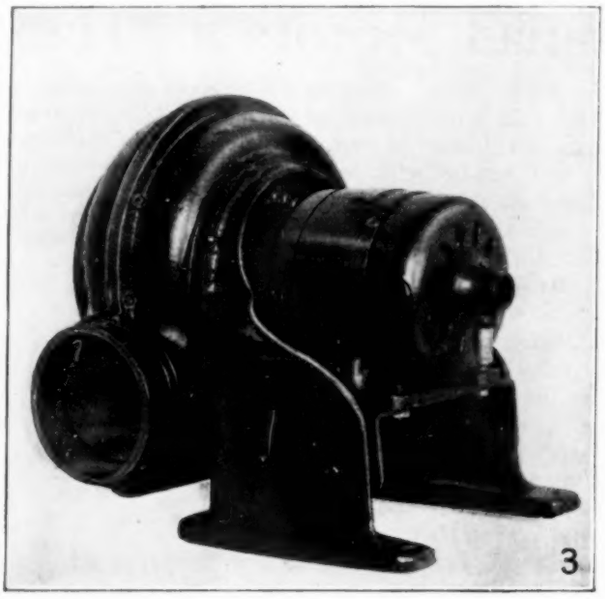
The other type of alternating-current motor in common use is that known as the induction type, which is equipped in the smaller sizes with a simple auxiliary device to make it self-starting under load.

Besides the alternating-current motors those of the direct-current type may also be used, and the practice has been standardized by some motor manufacturers to such an extent that the sizes of both alternating- and direct-current small motors, with the same operating characteristics and ratings, are the same so that either may be attached to a device at will.

### Small Induction Motors

In small induction motors the starting torque varies approximately as to the square of the circuit voltage. It follows therefore that if the circuit voltage is below normal, due to any cause, the ability of the motors to start under load will suffer more of a reduction than the amount of the reduce voltage. In good practice it is considered desirable to design the motor so that it will start up the machine to which it is connected with a voltage as much as 20 per cent. below normal.




FIGS. 2 AND 3. A GRINDER AND A FAN DRIVEN BY MOTORS

With he foregoing notes as a basis it will be possible to turn to some of the practical applications of the small motor in the shop field, and these applications in turn will serve to emphasize some of the preliminary notes regarding the types of small motors available and some of their uses and limitations.

### Description of Illustrations

Fig. 1 illustrates the compact appearance of a motor-driven drill[2], in which the extension line for making connections to a lamp socket or other receptacle is seen in the figure. Fig. 2 gives an idea of a portable grinding machine. In Fig. 3 the application of the small motor to a blower is shown. The motor has a rated capacity of $\frac{1}{10}$ hp. only, and is of the series type before referred to.

[2]Figs. 1 and 5 are due to the United States Electrical Tool Co.; Figs. 2, 4, 6 and 7 to Jas. Clark, Jr. & Co., and Fig. 3 to the Crocker-Wheeler Co.

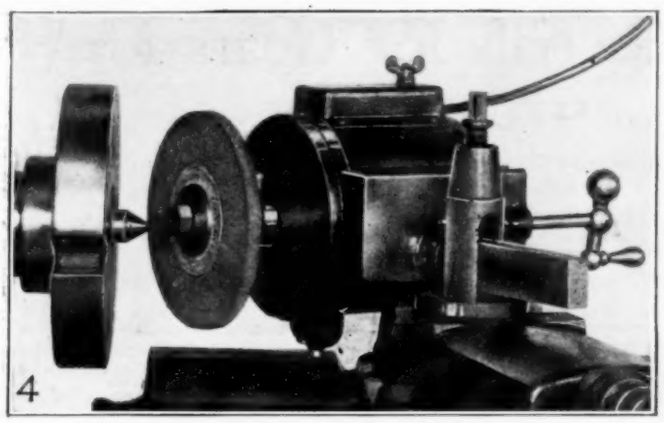


FIG. 4. GRINDING A LATHE CENTER

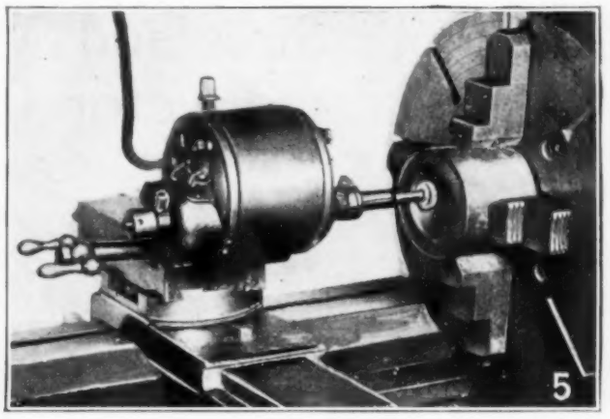


FIG. 5. INTERNAL GRINDING

However, the great convenience of these smaller motor-driven devices is perhaps best illustrated by views which show operating conditions. Thus Fig. 4 shows a small motor-driven grinder arranged for grinding a lathe center. The shank of the grinder is clamped in the toolpost of the lathe and the grinder is then placed in proper position and angle for grinding the center.

### Grinding Operations

The practice of one manufacturer is to make toolpost grinders of this general kind in a variety of sizes for taking wheels ranging from 4½ to 14 in. in diameter, split taper bearings being used so that the grinder may be adjustable for wear, and dustproof collars being employed to prevent the emery from reaching the bearings.

Fig. 5 shows a case of internal grinding which is readily accomplished by an extension arbor. Fig. 6 illustrates another adaptation of the toolpost type to grinding operations on lathes. Motor-driven grinders may be employed for light grinding generally and for bench grinding, or for surface grinding in shaping and planing machines. Fig. 7 shows a grinding operation on a planing machine.

It is perhaps evident that the small portable tool is not likely to receive as much care and attention as the larger apparatus in the shop. At the same time it is an advantage to know something of the kinds of items that are most likely to require attention in the operation of such light tools, as in the following notes based on General Instructions, sub-headed care of Electrical Tools, by the United States Electrical Tool Co.

If a portable tool fails to operate, first try out the supply circuit by inserting a good lamp in the socket. If the lamp burns it indicates that the trouble is between the socket and the motor or in the motor. Take off the commutator end of the motor and with the motor attached to the supply circuit note if there are any sparks at or near the brushes. Next note if the brushes are bearing on the commutator. Look at the commutator, and if it looks black or oily wipe it off with a rag and some kerosene. While inspecting and cleaning, the current must be turned off.

### Two Important Points to Consider in Operating These Tools

After the commutator is cleaned and the brushes have been found to fit on the commutator turn on the current again and try the tool. If it still refuses to work look at the commutator again and see if there is a burned spot between two of the bars. If a burned spot is noted take out the armature and return it to the factory for repairs.

Two of the most important points to consider in the operation of such tools are that they are oiled from time to time, and where brushes are used that they are replaced with new ones when the old ones are worn down. Where the tools are equipped with their own fuses failure of the tool to operate should be followed up by an inspection of these fuses, and if a burnt place is noted a new fuse should be inserted. Care should also be exercised to see that the brushes do not stick in the brush holder, as this will sooner or later keep the motor from operating.

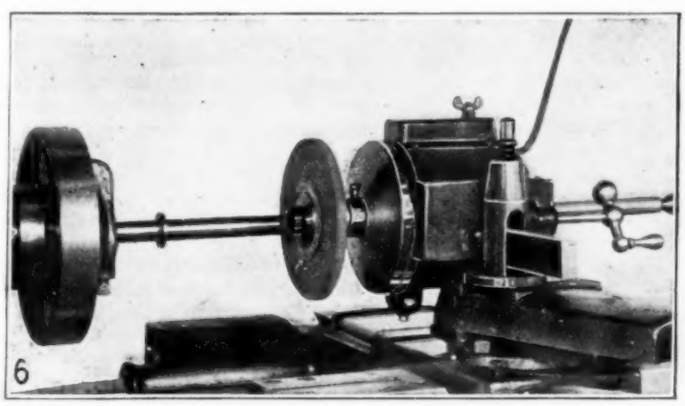


FIG. 6. CYLINDRICAL GRINDING

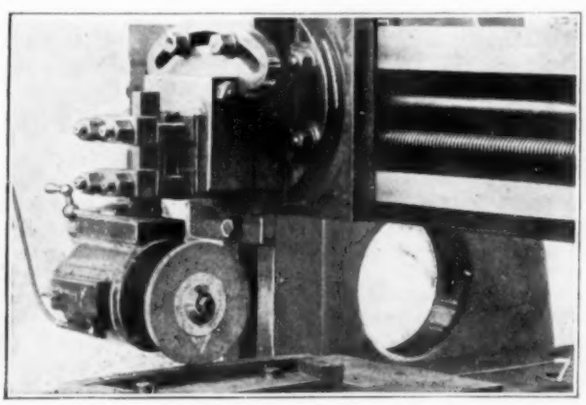


FIG. 7. GRINDING FLAT WORK

# Proper Sizes and Materials for Gears for Tractor Construction*

By E. J. Frost
Frost Gear & Forge Co.

THAT the tractor has come to stay and is going to be an important factor in the future development of the world, from an industrial and agricultural standpoint, few will dispute. That its manufacture and sale will add tremendously to the wealth and prosperity of those countries capable of producing and marketing it in any considerable quantities, also needs no debate. That the tractor of today has in any large measure reached its ultimate development and will satisfy the needs or ideals of the future, is very much open to question.

The histories of the pleasure car and the truck both point to development covering a period of years and, judging from the new features brought out each year, the end is not yet. It is therefore unreasonable to suppose that in the short time of experimenting and trying out in actual field service, a mechanism will have been developed that will measure up to the requirements of the future. From an engineering standpoint, the problem seems to have been approached mainly from two different angles, due to the previous training of what might be called separate schools of engineers.

Naturally one of the first to enter this field of endeavor was the man having had training and experience in making agricultural implements, with very little or no training at all in engine, clutch, transmission, differential and radiator design; and it is natural to expect that most of the thinking of this type of eningeer would be strongly biased by the previous experience with horse-drawn agricultural implements.

The other type came, naturally, from the pleasure-car and truck-manufacturing interests, and while he might have had all the experience and ability necessary in connection with the power end of the problem, he naturally was lacking in the lore of the implement man.

It is natural that the implement man should be biased toward the use of cast gears and unprotected internal gears and chain drives, and that to many such, strength and ability to resist wear should be represented only by cast-iron, malleable, or possibly steel castings, in most instances large to the point of being cumbersome, and frequently incapable of being properly housed to retain lubrication and keep out dirt.

The subject of upkeep, cost of repairs and accessibility of the parts is going to be given increasing attention by future buyers, and it behooves designers to spend any amount of thought and time necessary to attain the desired ends. A careful analysis of the physical properties of the cheaper materials sometimes used, as compared with even medium-priced alloy steels, will disclose the fact that smaller gears and shafts can be used, giving equal resistance to wear and shock and permitting assembling in much smaller housings, greatly facilitating protection from dirt and making it much easier to apply proper lubrication. I assume too, that frequently these substitutions can be made with little or no increased expense, due to the decreased size lessening the machine work, and the decreased weight offsetting the increase in cost per pound.

In a paper of this character, time will not permit of an extended discussion of the varied requirements to cover the entire gamut of tractor design as, in all probability, each case would have to be analyzed by itself, taking into account the power, speed, drawbar pull, weight and any other items affecting the required strength; and possibly considerable experimenting and field trials would be necessary to determine proper sizes.

It is apparent, even to the casual observer that both extremes have been reached. It is evidently unfair to ask a successful manufacturer of gears, on the one hand, to put his trade-mark on and guarantee the durability of another man's design, known to be wrong, because too light, and on the other hand compel him to equip his shop with machinery for cutting teeth of a size so large and overpowered as to make it only a question of a season or two before a decided alteration must take place.

It would seem, therefore, that the best interests of the tractor manufacturers would be conserved by conferences of their engineering staffs looking, as far as possibl . toward standardizing design and materials of construction, in an effort to improve the general average and increase the confidence of prospective buyers. It also might not be amiss to call for such help as the American Gear Manufacturers' Association can give and I am sure that I voice the sentiment of those here when I say that we would give nothing short of the best we have.

A carefully made 3½-deg. nickel, low-carbon steel suitable for case-hardening may safely be used for tooth pressures away in excess of common open-hearth steel. The same is true of chrome nickel and chrome vanadium; the latter, however, in the hands of those inexperienced in its heat-treatment to secure machineability, may find considerable difficulty in maintaining uniformly good results, and will have to slow down so much in making and cutting the blanks that the work becomes unprofitable.

Higher carbon (40-45) chrome nickel may also be used in many instances, with good results, as such material can be heat-treated to give the required physical properties so far as tooth strength is concerned, and when properly made by the mill will give good wearing service although soft enough so that a new file will bite the teeth.

The only trouble I have found with a steel of this analysis was destruction of the contact surfaces of the teeth due to what is termed "pitting" and the only explanation we could find for our difficulties was that something had gone wrong in its manufacture at the mill. The chemical analysis showed material up to specifications and the microscope revealed nothing that we could assume pointed to trouble. However, the trouble existed and in our efforts to eliminate the difficulty we experimented with steel of the same analysis but with the carbon content increased from 0.37 to 0.45.

This did not remedy the pitting, and I went so far as to take out a set of gears from an automobile transmission after having been driven 20,000 miles and showing no appreciable wear, and substituted a set made from the chrome-nickel steel of 0.45 carbon and with the scleroscopic hardness (checked by the Brinnell machine) considerably raised, and these failed, showing considerable pitting in 500 miles.

It is therefore evident that where steels are to be used in service that will approach the destructive limits, great care must be taken to see that they not only check up as to chemical analysis and physical properties as ordinarily determined, but that experiments should be made to satisfy us that the individual batch of steel under consideration will stand up under the proposed load, speed and other conditions.

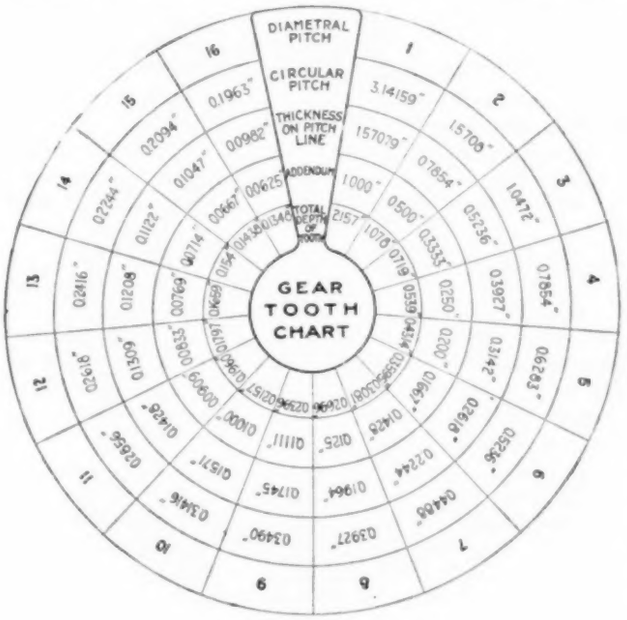
My criticism of what I saw at the Kansas City tractor show is along two lines: First, such a multiplicity of levers, reach rods, valve tappets, links, chain drives and in too many instances gears unprotected from dust and grit, so that unless an owner spent most of his time wiping up, the tractor never would be cleaned; secondly, and to my mind a serious matter, the bull gears and main drive pinions, and frequently other gears, were left unprotected, I imagined, due to excessive size, which can be corrected only by using better materials of construction which will tolerate adequate protection without making the housings too cumbersome.

*Presented at the annual convention of American Gear Manufacturers' Association, Cleveland, April 15, 1919.

## Gear-Tooth Chart

By J. H. Moore

I had considerable gear work to do, so I constructed the chart shown in the illustration, which operates as follows: Bearing in mind that the various figures around the chart represent the values of the different




GEAR-TOOTH CHART

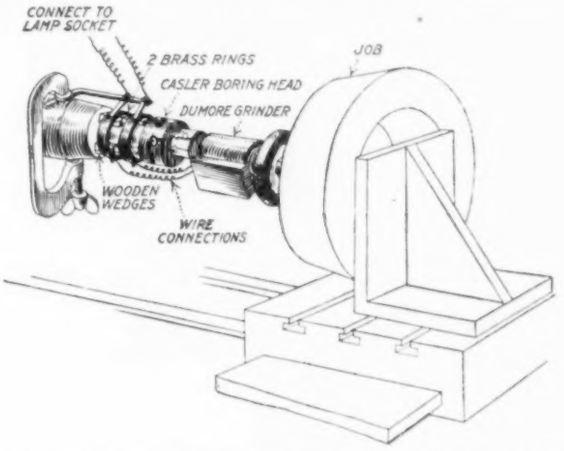
diametral pitches the key-shaped piece is moved over to the pitch desired and all the necessary dimensions can then be read at a glance. This scheme has proved a time saver of no mean proportion and is well worth the work spent on its construction.

## Grinding Large Ring in a Boring Mill

By James Mitton

The sketch shows the manner in which I ground a ring in place on a fixture in a Lucas precision boring mill. Having no lathe large enough to swing the work it was clamped on an angle plate on the platen of the boring mill and set up as if for boring. A Dumore tool-post grinding machine was mounted in a Casler offset boring head. To carry the electric current to the motor I took two brass rings (scrap ends of bushings) with a 4-in. hole in them and secured them in place on the spindle of the machine with hardwood wedges, this method enabling me to true up the rings and at the same time insulate them electrically from the spindle. The leads from the motor were then soldered to their respective rings.

Two brass strips or brushes were then fastened by screws to a board which was secured by clamping to




A KINK FOR THE INTERNAL GRINDING OF LARGE DIAMETERS

the spindle handwheel bracket in position to bring the brushes to bear upon the rings. Wires from a convenient lamp socket to the brushes completed the circuit allowing the grinding wheel to run continuously while feeding the platen forward and backward to grind through the ring.

The job was finished as well as could be done in a regular grinding machine and in a very reasonable time. The sketch shows how the connections were made.

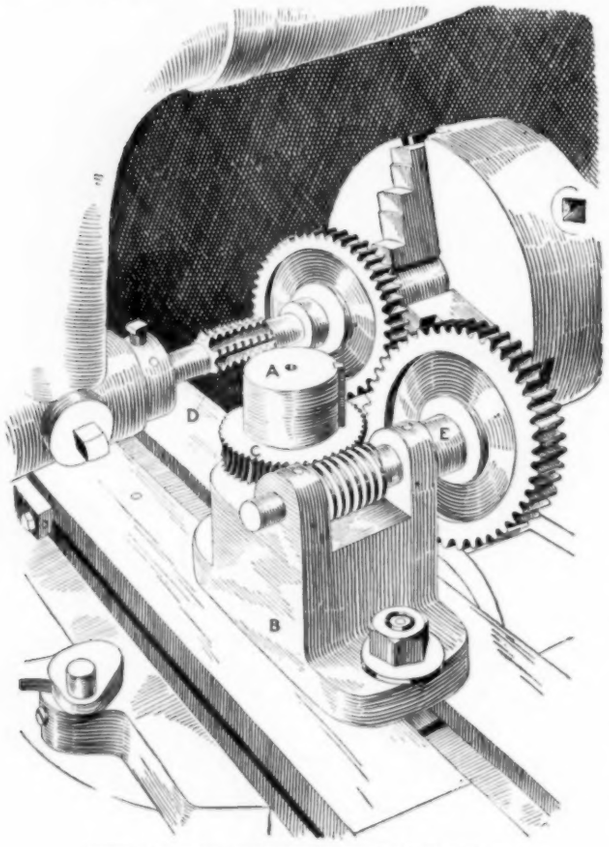
## Hobbing Wormwheels Without Gashing the Blanks

By Bernie Soulf

Oscar Craft describes on page 41 of the *American Machinist* how he rigged up the dividing head of his milling machine to hob some wormwheels without the usual preliminary of gashing the blanks. This seems to me to require considerable rigging up and to be not particularly good exercise for the dividing head. The fixture I am showing in the accompanying cut, while it has no advantage in the way of preliminary rigging, is still very simple to make, is very sturdy and efficient, and does not involve the dividing head at all.

The short stud *A* turns freely in a bronze bearing sleeve forced into the casting *B*. The wormwheel *C*, a duplicate of the wheels to be cut, is keyed to this stud, the key extending to the top of the stud. The latter

is made a light drive, or hard push fit for the bore of the wheels. The hob *D* is held in the chuck of the milling machine and is geared, even, to the worm shaft *E*. In operation, a wormwheel blank is tapped onto the shaft with a mallet or piece of lead, and the table of the milling machine is fed straight toward the hob until




DEVICE FOR HOBBING WORMWHEELS

it reaches a set stop, at which point the work, after making a revolution or two to cut clear, is finished. The table is then withdrawn and the completed wormwheel lifted off the stud with two small specially made pinchbars.

The gears on this device would ordinarily constitute a considerable item of construction, but in most machine shops a suitable pair of gears may be found close enough to requirement to allow the device to be adapted to them. No leeway can be had in respect to the diameters of hob, wormwheel and worm, but the center distances of the gears may be accommodated within reasonable limits by a spacing collar of the required thickness between the driving wormwheel and the blank being cut. This separates the planes of the hob and worm shafts in a vertical direction and compensates for slight variation in this respect. No such compensation was necessary in the case illustrated.

When starting a blank toward the cut, the gears are of course out of mesh and must be entered carefully, but if gears of sufficiently coarse pitch are chosen, they will connect before the hob touches the work, will work toward the proper position as the cutting proceeds, and will be running on their pitch circles when the work is completed.

This device has seen long service and has turned out wormwheels at the rate of four per hour continuously.

## Form-Milling a Wire to a Peculiar Cross-Section

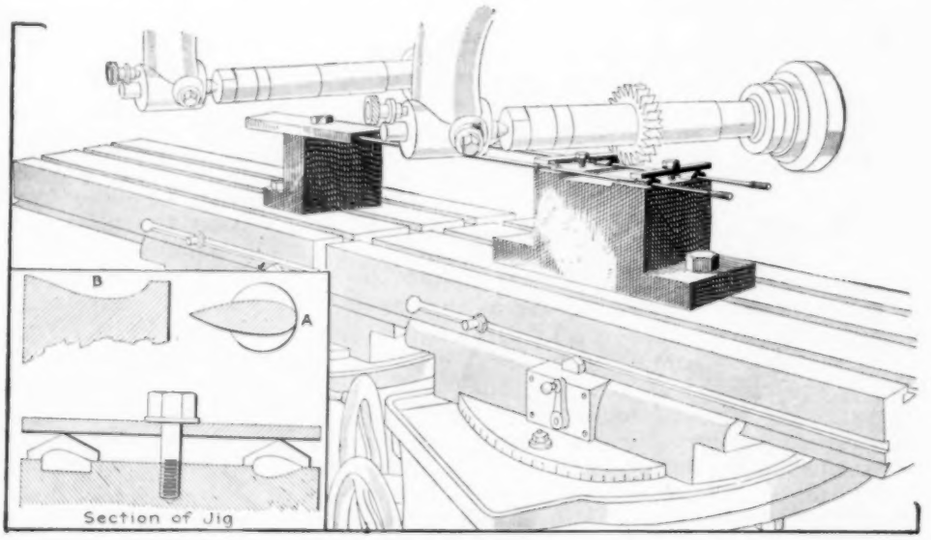
BY ADOLPH MOSES

Some time ago I was called upon to make the wires shown at *A* in the sketch. Originally it had been intended to draw this wire to form and then upset and thread the ends, but this method did not work out, and as only a few wires were needed at the time and the stock available was ½ in. in diameter and rough, I proceeded as follows:

The ends of the rods were turned and threaded in a lathe. Then by holding in an ordinary milling-machine vise and shifting and resetting after each cut a flat was milled on one side to the proper depth. Next the rod was turned over and another flat milled, bringing the wire to the correct width, leaving a few thousandths for finishing. After the other two sides were milled the wire was rectangular in shape except for the round ends.

A formed cutter, shown in section at *B*, was made from an old milling cutter by dressing a grinding wheel to the proper shape and then feeding it radially into the cutter, using a stop on the grinding-machine table to get all the teeth the same height. The contour of the grinding wheel was tested by cutting a piece of sheet metal with it and testing the profile by means of an accurately filed templet.

Two milling machines which happened to be properly located were used for the milling. The rectangular wire was lightly clamped in the jig as sketched and the jig bolted to the table of the first milling machine, this table being rigidly held against end movement. The feed was obtained by means of a tie rod running from




AN UNUSUAL MILLING JOB

the wire end to the table of the second milling machine. In this way the full travel of the second table could be used before it was necessary to return, get a new grip on the tie rod and start the machines again without disturbing the wire in the fixture. When one side was milled to form the wire was turned end for end and inserted in the other side of the fixture in which was a slot formed to fit the recently milled contour. The other side of the wire was then milled to form in the same manner.

Each end where the cross-section changed from the fish shape to the circular was shaped by filing. Had not this method been used it would have been necessary to hold the wire in a vise and reset it after each cut, and this would have been very difficult to do with this peculiar shape.

Perhaps the wire might have been laid in a long groove and fed in the same direction as the cutting teeth of the milling cutter. At any rate the method used produced the wires with remarkable accuracy as some of them did not vary a thousandth of an inch in 7 ft. of length.

## Electric Annunciator Applied to Group Machine-Tool Operation

By A. Des Angelis

An example of group-machine running is shown by the illustrations, Fig. 1 showing the arrangement which includes gear-cutting and generating machines, milling machines, etc.

Each machine is provided with an electrical contact so arranged that when the machine completes its cycle it rings a bell and releases the corresponding indicator needle on the annunciator. The operator determines by a glance at the latter which of the various machines needs attention, makes the necessary adjustments and resets the needle.

One of the contacts is shown at *A*, Fig. 3. It is very simply made, being but a piece of spring wire wrapped around the hub of the indexing wheel of a Gleason gear generator and a contact finger attached to the gear guard. The guard is insulated from the machine, and guard and machine are connected to opposite legs of an electric circuit which passes through the annunciator. In Fig. 2, is the annunciator, which by means of bell and indicator needle warns the operator which machine has completed its cycle. This device has been in service for a considerable period and has saved its cost many times by eliminating the necessity for the operator to watch all machines at once.

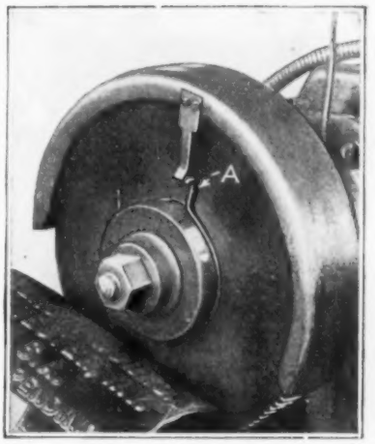



FIG. 3. DETAILS OF ELECTRIC CONTACT

## A Cheap Adjustable Die

By J. J. Voelcker

A die needed for cutting a 1-in. outside diameter thread, eight threads per inch, on bronze cleaning rods was made in the following manner. The body was a 4-in. piece cut from a bar of $\frac{3}{4}$-in. x 4-in. cold-rolled stock and was bored centrally to $1\frac{5}{16}$ in. diameter. The six dovetail slots shown in the figure were then cut and carbon-steel chasers inserted. The hole for the No. 3 taper pin was drilled and reamed and the slot cut which bisects the hole. The hole for the $\frac{3}{8}$-16 fillister head capscrew, which clamps the die on the taper pin, was next drilled and tapped, and the taper pin inserted and locked with the clamp screw. The die was then bored to the proper size and the chasers threaded, hardened and ground. Two corners were cut

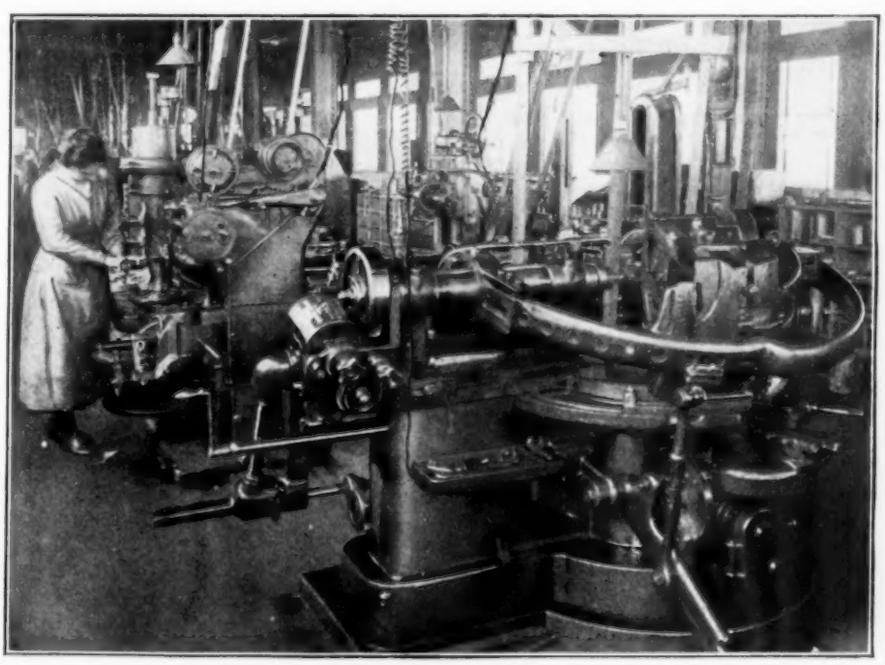
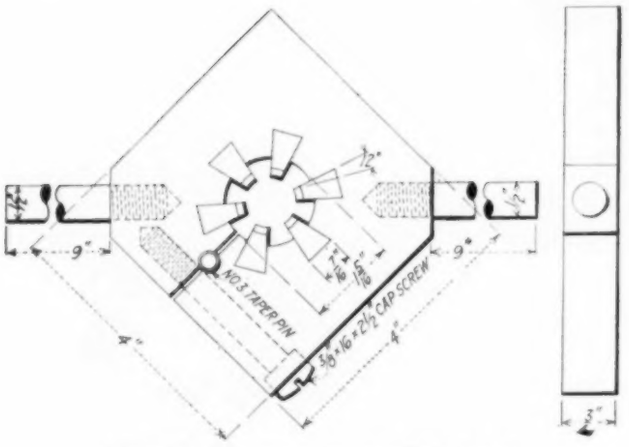


FIG. 1. MACHINES EQUIPPED WITH ELECTRIC TELL-TALE

FIG. 2. THE ANNUNCIATOR




ADJUSTABLE DIE FOR BRONZE RODS

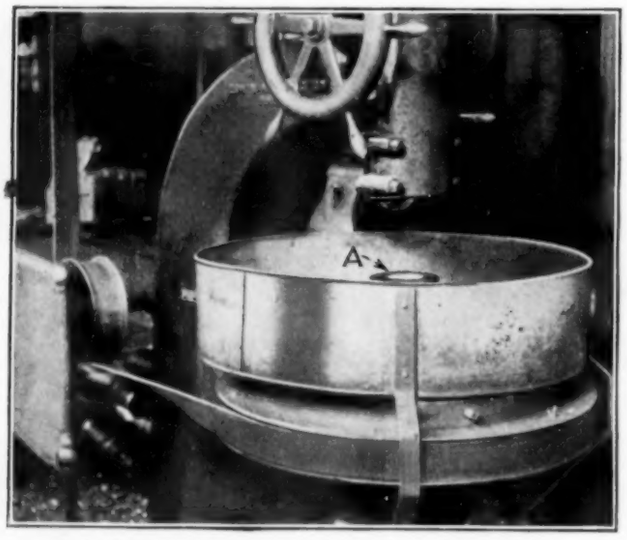
off, and the resulting flats were drilled and tapped for handles made of ½-in. round cold-rolled steel. The die was used on 5000 pieces without the need for regrinding and was apparently good for many more when production ceased.

## Direct Drive on Table of Boring Mill

By J. Wright

A special drive has been used to speed up the table of an old vertical boring mill in the shops of the Chicago Surface Lines in order that it may be used for boring the babbitt lining of motor bearings. The bearings are held in a three-jawed chuck as shown at *A*. It was found impractical to secure a sufficiently high speed with the regular geared drive of the machine because of the vibration and chattering which resulted. The drive is by belt from an overhead counter and is brought down over idler pulleys and around the rim of the table. Flanges were put on top and bottom sides of the table to prevent the belt from slipping off.

The table now runs at a speed of 150 r.p.m., and to overcome its momentum when power is shut off it is provided with a leather-faced wood block for a brake. The result of this arrangement has proved satisfactory and the operator is able to attain rapid production.

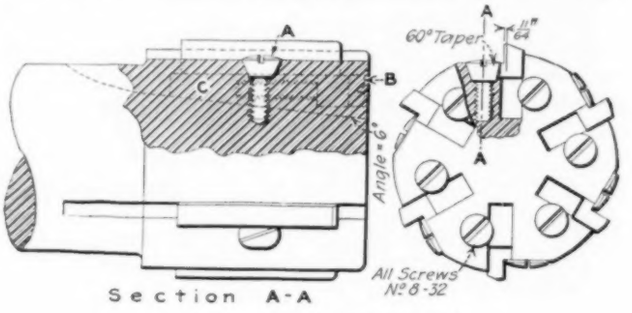



DIRECT BELT DRIVE ON TABLE OF VERTICAL BORING MILL

## Special Reamer with Adjustable Blades

By C. H. Dengler

The accompanying illustration represents a type of adjustable reamer in which the blades are adjusted by means of a taper wedge in place of the customary shims. The principle is readily adaptable to any size or design where inserted blades are used. The soft steel body is milled with six $\frac{3}{16}$-in. slots the bottom of which are at an angle of 6 deg. from the axial line. The body is drilled and tapped for the special screws




ADJUSTABLE BLADE REAMER

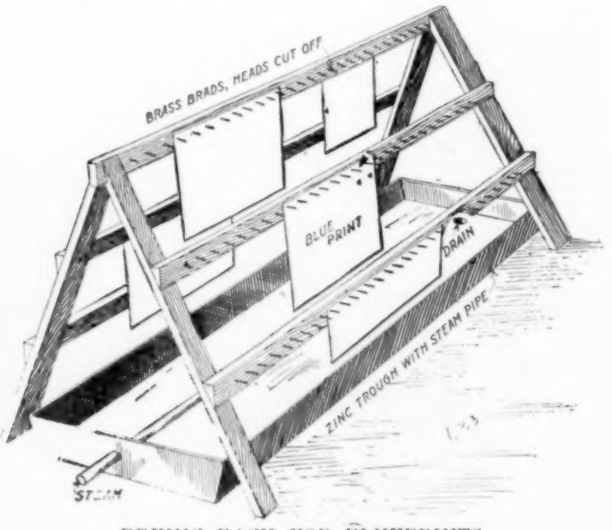
*A* and *B*, there being six of each. The tapped holes for screws *A* are countersunk 60 deg., while the holes for screws *B* are counterbored. The wedges *C*, which snugly fit the slots, are actuated by the screws *B*. Turning a screw moves the corresponding wedge in, and thus tends to raise the blade. A $\frac{1}{16}$-in. movement of the wedges increases the diameter of the reamer 0.013 in. This design gives a good dependable finishing reamer.

## Frame for Drying Blueprints

By A. P. M. Wilking

The sketch shows a device for drying blueprints in the small shop. The A-shaped frame has horizontal bars which are provided with headless brass brads projecting about $\frac{3}{16}$ in. and spaced 3 or 4 in. apart.

The wet blueprints are pushed over these brads, which




DRYING RACK FOR BLUEPRINTS

make it very easy for one person to handle the prints, even if they are of large size.

The water drips into a zinc trough provided with a drain. A steam pipe furnishes the heat for quick drying.

# The Security Chucking Grinding Machine

TO MEET the increasing demand for a heavy-duty internal grinding machine the Security Tool Works, Chicago, Ill., has brought out a new machine of the type shown. This will be marketed by the Security Mechanical and Engineering Sales Co., 115 South Clinton St., Chicago. This machine is intended for manufacturing purposes as well as for the toolroom.

The maximum capacity of the machine is 14-in. swing with lengths of work up to 12 in. It is provided with a base inclosing all of the feed and speed change gears which are operated by levers on the apron. The chrome-nickel steel grinding spindles are hardened, ground and lapped, and run in alloy-bronze bearings. These bearings are mounted in a cylindrical sleeve, which in turn is held in the bore of the support bracket by three clamp screws. The wheel end of the spindle is tapered, and has a threaded portion on the extreme end, thus allowing different diameters and lengths of extensions to be screwed on, and eliminating the use of long spindles on short holes. One of these extensions can be seen lying on the table of the machine, Fig. 1. The bearings are dustproof and provided with adjustment for wear. The interchangeable grinding spindles are made in three sizes, the two large-size spindles have each a range of four speeds, 3500, 4500, 7000 and 12,000 r.p.m.; while the small spindle has one speed only, 25,000 r.p.m. The three spindles are identical in construction and differ only as to size. They are driven by a belt from a pulley mounted on an intermediate shaft, and by changing this pulley the different wheel speeds are attained.

The intermediate shaft runs on SKF ball bearings mounted in a dustproof housing bolted to the swivel base, which also holds the grinding-spindle support bracket. The graduated swivel base will swing 45 deg.

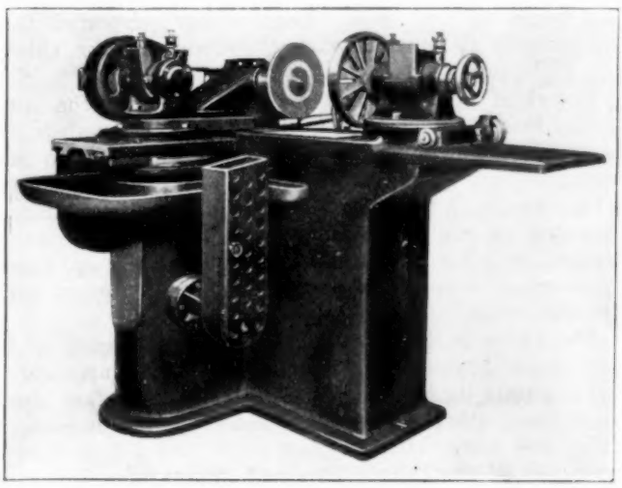


FIG. 2. REAR VIEW CHUCKING GRINDING MACHINE

Floor space: Length, 80 in.; width, 32 in.; height, 52 in.; weight, 3500 lb. Countershaft pulley: Speed, 500 r.p.m.; diameter, 12 in.; belt face, 3 in.

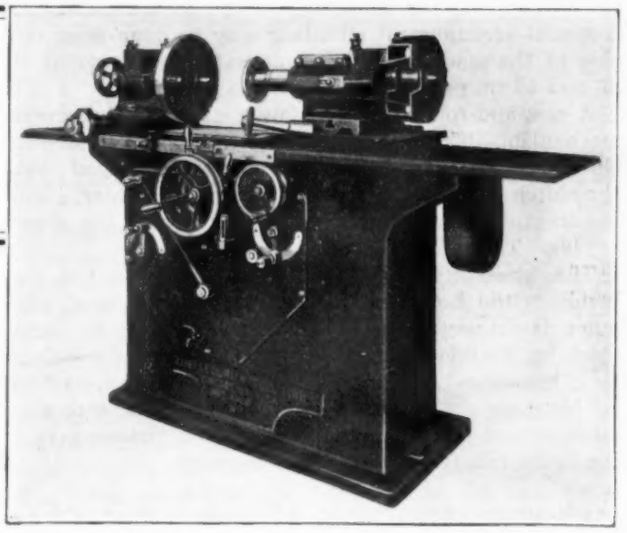


FIG. 1. THE SECURITY CHUCKING GRINDING MACHINE

on each side of center, and is mounted to a taper gibbed dove-tail slide, which is operated by a handwheel with graduated dial located at the front of the machine.

The headstock of rigid design swivels, and is graduated for 45 deg. It is provided with a worm and sector arrangement with a dial mounted on the worm-shaft and graduated to read taper per foot and also angular measure. This device is provided with adjustments for wear in all directions.

The headstock spindle is of chrome-nickel steel, hardened, ground and lapped, and has a hole through the center to receive a draw spindle. The front bearing is of tool steel, hardened and ground, and is of a taper-cone construction. The rear bearing is of bronze, and both bearings are dustproof and provided with ample compensation for wear.

The draw spindle is tubular, permitting the wheel lubricant to be fed through the center. The faceplate and chuck are mounted on hardened and ground collets. Split collets are carried in stock up to and including 2½ in. in diameter, and special over-size collets can be furnished up to 6 in. in diameter.

The work spindle has six different speeds, 40, 60, 126, 160, 240 and 500 r.p.m., and all different changes of speed, as well as the stopping and starting, are done by levers in front of the machine, which connect with the gear-chain mechanism inside of the base. A 2½-in. belt connects this gear box to the countershaft by a jackshaft on the right side of the machine, and this shaft is connected to the gear box by a silent-chain drive.

After undergoing the various changes of speed, the gear box is again connected by a silent chain to a jackshaft on the left side of the machine, Fig. 2. This shaft is connected by a belt to a double idler pulley on the countershaft, which drives the cylinder with a short over-head belt. All spindles, clutches and pinions in this gear box are made of chrome-nickel steel, hardened and ground: and all bearings are bronze. The gear box is filled with oil, and a glass in front indicates the proper oil level. This gear-box arrangement permits speed changes while the machine is in full operation or at rest.

The table is 55½ in. long by 14⅞ in. wide; it slides on two 2¼-in. V-ways which are 19 in. between centers, these being provided with oil pockets with rollers on

spring supports for delivering the oil to the slides. By a special arrangement all oiling may be done from outside of the machine. The table has three feeds of 20, 35 and 55 in. per min.

A cam-and-roller construction is used for the reverse mechanism. The cam is so designed as not to move the clutch fork, leaving the clutch teeth engaged until the clutch lever has traveled slightly over center, insuring instantaneous reverse movement without the slightest jar. The table reverses on a ⅞-in. stroke.

The wheel lubricating pump is located in the rear inside of the base, and is driven by spiral gears. The pump is connected to the draw-in spindle of the headstock by flexible tubing, and the lubricant is regulated by a handwheel on the apron in front of the machine. All bearings not immersed in oil are provided with glass oil cups, and the loose pulleys as well as the hangers on the countershaft have SKF ball bearings.

## Acknowledgment to M. Schneider et Cie.

In the series of articles recently published in the *American Machinist*, describing the manufacture of the 155-mm. howitzer at the plant of the American Brake Shoe and Foundry Co., mention was omitted of the fact that Schneider et Cie., of France, are the originators of this type of howitzer as well as of the 240-mm. model 1918. The American Ordnance Department adopted these two sizes of French howitzers, and Schneider et Cie. has furnished to the Ordnance Department assistance such as is outlined below:

M. Schneider et Cie. provided us with the complete plans of this material; the specifications of metals for different parts, also the treatment of these metals in order to obtain the necessary characteristics; the complete plans of all the fixtures employed in their establishment for the execution of this material, and the complete plans of all the shop gages for the final examination of the gages and their instruments.

For the 155-mm. howitzer they supplied two sets of principal gages and instruments, also the complete data of manufacture regarding each piece; the series of operations; their duration and kind of machine used. They gave us the complete lists of the machines necessary to complete five of the 155-mm. type each day, together with photographs and films showing the different operations of machining; the securing of the pieces upon the machines; the construction of the equipment employed; the kind of tools; the inspection; gages; etc.

Messrs. M. Schneider et Cie. permitted American officers, engineers, foremen and mechanics to take a course of instruction in their workshops in France in order to enable them to employ their processes of manufacture, material, etc., in the production of artillery. These officers, etc., were either representatives of the Ordnance Department or representatives of private manufacturers delegated by the Ordnance Department. Messrs. Schneider et Cie. sent to the Ordnance Department a contingent of eight engineers, a foreman, and specialists to give information in all of the branches needed. Members of this contingent were either assigned to fixed places in factories or moved about in various workshops following the manufacture of this material.

Factories in the United States manufacturing the 155-mm. Schneider howitzer model 1918, were as follows: American Brake Shoe and Foundry Co., Erie, Penn., cannons and breeches; Osgood-Bradley Car Co., Worcester, Mass, gun carriages and cradles or saddles for heavy guns; Mosler Safe Co., Hamilton, Ohio, gun carriages and cradles for heavy guns; Dodge Bros., Detroit, Mich., sledges for transportation of heavy guns; Maxwell Motor Co., Detroit, Mich., limbers; Accurate Engineering Co., Chicago, Ill., wheels.

Factories in the United States building the 240-mm. Schneider howitzer, model 1918, were as follows: Arsenal at Watervliet, Watervliet, N. Y., cannons and breeches; Watertown Arsenal, Watertown, Mass., complete gun carriages; Cambria Steel Co., Johnstown, Penn., gun carriages; Knox Motors Co., Springfield, Mass., limbers and hind carriages; Pressed Steel Car Co., Pittsburgh, Penn., platforms; Standard Steel Car Co., Hammond, Ind., complete gun carriages; Otis Elevator Co., Chicago, Ill., sledges for transportation of heavy guns; Davenport Wagon Co., Davenport, Iowa, limbers and hind carriages; Kelsey Wheel Co., Detroit, Mich., wheels.

That these companies deviated in many cases from French methods of manufacturing and installed methods of their own does not in the least detract from the credit which Messrs Schneider et Cie. deserve for their wholehearted coöperation and able assistance.

## The Value of Written Instructions To Draftsman

By John S. Carpenter
Associate Member American Society of Civil Engineers

The chief engineer came into the drawing room looking as pleasant as if he had a mouthful of castor oil. Throwing down a pile of blueprints in front of his assistant, he exclaimed, "Look here, Bill, I told you very distinctly that this Brown order was to have all wearing surfaces bronze lined. It's been sent through just as if I hadn't said a thing! I caught it in time, before it got into the shop. Darn this forgetting things!"

"I'm sure that I told the draftsman about it! The checker passed it, too!" Bill returned, and took the drawings out to the draftsman and started to give him a piece of his mind.

The draftsman took out a little book where he had jotted down Bill's instructions and showed the assistant just what he had said. The checker supported the draftsman's statements when questioned by the chief, and Bill certainly felt uncomfortable.

The chief picked up a scale and laid down the law. "After this," he stipulated to Bill, "you make an abstract of the essential points on each order, dictate it to the stenographer, give the original to the draftsman and a copy to me. I want it all in black and white; no more guessing or relying on memory. There's more time wasted and hard feeling created in fixing up these blunders to more than pay us to keep an extra girl for that work."

The above is not fiction. It is true and every chief draftsman knows it. Verbal instructions are unreliable unless they be of the simplest and briefest kind. Even then, other matters may intervene, sickness may delay the work, etc., so that when the job is taken up again all the instructions and impressions are cold. To regain these, it is necessary to go over the entire work again and the chances are that something will be forgotten.

# EDITORIALS

## Let's Go!

SOME of the buyers of machinery are taking a little snooze while waiting for prices to drop. If they do not wake up pretty soon they are going to find that a few of the live wires have gotten a start that will keep them ahead for the next ten years. For prices are not going to drop.

Price level can be pictured as a level of a great ocean. If this level were to rise three or four feet, some of the boat houses and piers on the shore would be so low that people on them would get their feet wet. If under these conditions a convention were called to consider what was to be done to remedy conditions, we imagine that it would be decided to be more feasible to raise the level of the piers and boat houses than to lower the level of the ocean.

This rising tide of price averages has carried the majority of wages with it. There are some instances (and these are making most of the trouble) in which individuals are getting their feet wet because the wages that support them have not risen to the new level of the price ocean.

Prices are not going to drop. If anything they are going to rise, except the few that are inflated beyond a reasonable margin of profit. Prices that are honestly based on cost are bound to rise for the simple reason that cost is based on labor and we face an inevitable labor shortage within the next ten months. The rate of emigration of labor assures us of this fact without the shadow of a doubt. Everybody believes that six or ten months from today, after the adjustments have been made, business is going to increase. How much drop in the cost of labor do you expect *then* with increased demand, when you find it extremely difficult to get skilled help *now?*

The bright boys who are getting the jump on the other fellows are the ones who have thought out these facts and who are taking advantage of them. They know that there is going to be a pretty stiff race during the coming ten years and that the wheels must turn with a minimum amount of friction and the maximum of speed. They know that the man who gets his car oiled up and adjusted and running perfectly the day before an automobile race has more chance to win than the fellow who begins to oil up and adjust and replace parts after the starting shot has been fired.

For the past four years there has been less maintenance of machinery and machine shops than during any other like period in our history. There hasn't been time, nor has there been men enough to maintain our machinery in first-class condition. It has been a case of making every tool work as nearly twenty-four hours as possible. The machine shops of America are on the average, therefore, decidedly *not* in first-class order for the coming race.

These live wires who are getting the jump on the other fellows are going about their business quietly but very effectively. They are putting their plants in prime condition for the big race. They are rearranging, repairing, altering; making use of every bit of valuable and costly experience gained during the war. They are searching the market for machinery which will produce at a more economical rate than that which they already have; appreciating the fact that, with labor costs rising, the man who succeeds must utilize improved machinery. They are installing lunchrooms, cafeterias, better heating and ventilating systems, better lighting arrangements; knowing that if they are to attract labor in a competitive market they must offer inducements of this kind. They are making use of the present comparative abundance of labor to do the things that *you*, if you do not do them now, will find it impossible to do ten months from now.

These fellows are shrewd enough to know that when the rush begins the fellows who have been holding off will find themselves permanently handicapped. The man who knows that his shop should be rearranged and reëquipped, but who is waiting for the price of day labor to drop so that he can rearrange those machines at less cost than he can now, and who is waiting for the prices of machine tools to drop so that he can reëquip his shop at less cost than he can now, will find that this policy of procrastination has cost him his chances of winning the race, and that he will have to make ten times the effort to keep abreast that he would have found necessary, had he read the times right.

How is your shop? Is there a department that needs rearranging? *Do it now!* Are there new motors to install to get more power or flexibility? *Do it now!* Are there machines on the market superior in production to the ones that you are using? *Install them now!* Do the line shafts need relining, boxes need rebabbitting, and general equipment need repairing? *Do it now!*

Paste this in your hat: Unless you're a dead one you've got a considerable distance to go and the sooner you get started the sooner you'll get there. Perhaps you are one of the live wires who have already made a start but, if not, take our advice and *do it now!*

Let's go!

## They're At It Again

THE baccalaureate Bolsheviki who believe that the sun, moon and stars operate exclusively on the metric system, are making another attempt to upset America's industrial digestion by forcing us to take a dose of their dangerous concoction. Their slogan is "You need a meter-liter-gram." This time the propaganda is fathered by the "World Trade Club, San Francisco, U. S. America." By means of a circular and stamped envelopes they are beseeching that we petition His Excellency David Lloyd George, and His Excellency Woodrow Wilson, that they pause a moment from their trivial duties of rearranging world boundaries and national relations, to take up the really important work of abolishing the yard and the inch.

These ardent reformers apparently find in the prohi-

bition act and in the proposal to eliminate the curse of tobacco by force, an indication that the time is ripe to do away forever with the curse of the inch, pound and foot.

To those of us who have to do with machinery and the mechanical arts in which the establishment of standards has built up an invested value of many billion dollars' worth of equipment, tools, jigs, fixtures, etc., all made to English measurements, this proposal appears in its true light; namely, the childish prattle of the "anti-izzers"—who believe that because things *are* they must be wrong.

Engineers, manufacturers and mechanics, perhaps unfortunately, see so clearly the futility of permanently removing the foundation from under American industry by philosophical fiat that they do not regard these attempts of the "I want things my way-ers" very seriously. We say "unfortunately" because those whose experience does not put them in a position to measure this propagandic twaddle at its true value are likely to be influenced by the specious attractiveness of the theory proposed, although as far as this spasm offered by the World Trade Club is concerned, there is little danger of any educated man reading their pamphlet without getting the impression that the mental processes of these metric mentors is as disjointed as their expressions of facts.

For example, quoting from page 4 under the heading of "It is all very simple. . . . U. S. American Bureau of Standards, Director S. W. Stratton, tells, in an admirable article in Americana, the Scientific American Encyclopedia, in sense 1 per cent.—read the other 99 per cent. in Americana—metric system—the world's one system."

This may be futurist or cubist talk or perhaps an imitation of Irwin's Japanese school boy, but it would surely take the ability of a corkscrew mind to follow the logic of this sentence.

A map is reproduced in this 16-page effusion, showing the "well-nigh world-wide use of metric units." The United States and Canada on this map are described as, "Countries using coins of metric weight and measure decimally divided," (nothing said about the half-dollar or quarter of course); "exclusively metric postal union," (nothing said about the ounce under which all of our postage is carried); "metric units in electric industry, in science, liberty motor airplanes, Brit.-Am. helium Zeps (science's wonder of the world war); indorsed by organized manufacturers, steel, tanners, furriers, canners, packers, growers, miners, grocers, fishers, recorders, writers, draftsmen, labor, cooks, waiters, shippers, traders, furriers, world advertisers and women, so on, so on."

What a pathetic picture! Think of the poor fishermen who are now deprived of their catches because they have no metric worms, of the canners and growers who see golden opportunities withheld them because this Government does not compel by law the asparagus and tomato plant to grow to metric measure, the cooks who find that a "pinch of salt and a cup of flour" are an aggravation to their culinary art, the poor waiters who are compelled by heartless Congress to face the insult of a 25-cent tip where there should be but dimes, dollars and pennies. But most pathetic of all is the thought of the poor women at the end of the list sewing on buttons to the hated English system of measurement.

The usual hackneyed arguments, expressed rather less cleverly than usual, however, are found in this World Trade Club's circular. Great capital is made of the fact that the simplification of arithmetic would save many hours of trial and tribulation to the suffering school child, overlooking the fact perhaps that the best way to save a school child from trial and tribulation is not to make him study at all.

Secretary Redfield is quoted as follows: "The fact, of course, is that the metric system, adopted exclusively by 34 nations is simpler, easier, more effective, and more widely used than any other. It has made its way by its merits. There is no argument for the retention of our present weights and measures that is not an argument against our decimal metric dollar system. No reason supports our decimal-dollar system of currency that does not support decimal system of measure. This handicap we must throw off, get out of the darkness—out of foolishness toward reason." Perhaps the honorable Secretary in his close association with the Bureau of Standards, which appears to be the self-constituted hotbed of metric propaganda in America, had been getting a whiff or two of the famous six-cent per gallon Liberty fuel.

It is difficult to become angry at a comedian and herein lies the danger, for the sort of talk put out by the World Trade Club contains so much that is laughable and side-splitting to the man of sense that laughter leaves him weak.

We strongly advise you as a precaution against a paralyzing industrial calamity which would follow the abandonment of our standard tools, gages, jigs and fixtures, and more serious than that, the abandonment of our instinctive familiarity with our own measures—to tell your Congressman what the loss of the inch and the foot would mean to *your* business.

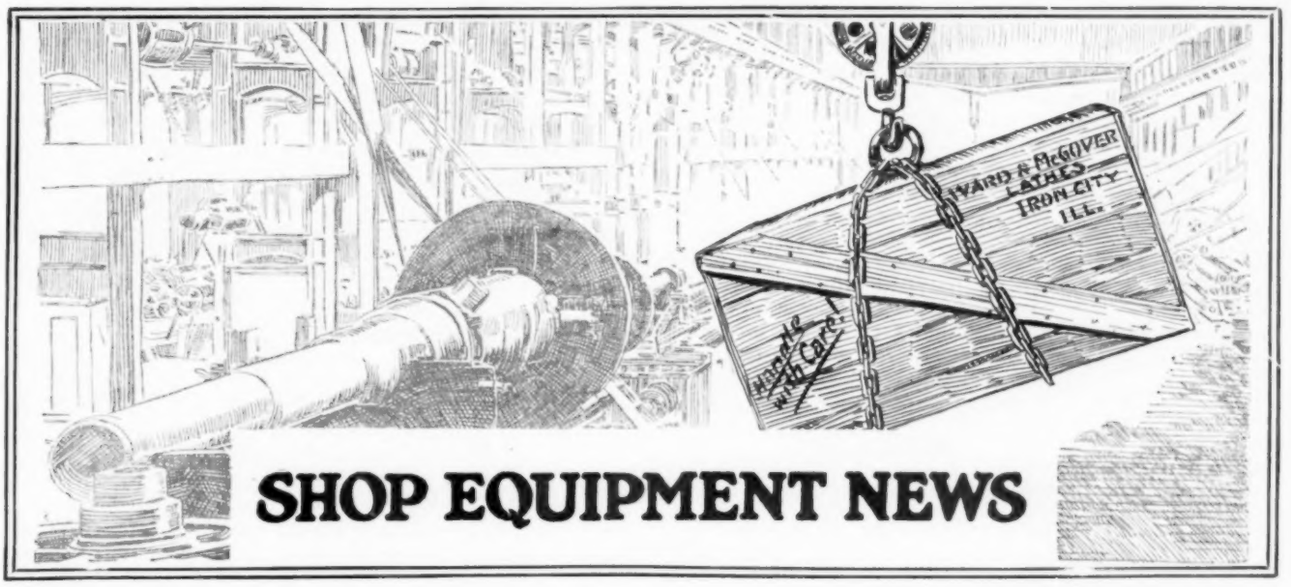
## How's Your Imagination?

HAVE you ever stopped to consider the effect of *imagination* on present-day mechanical creation? Necessity provides the itch, it is true, but necessity without imagination is like an armless man afflicted with the "cooties."

War has brought necessity to our doors by destroying a vast amount of manufacturing man-power. As normal conditions return, the war-engendered itch for more efficient production must be satisfied by improved machinery. This crippled world must be fitted with mechanical limbs. Herein lies a task for the machinery builder and for imagination. Users feel the necessity but are helpless without the trained machine designer.

Webster says that imagination is the power of having mental images. Did you ever examine one of yours or try to draw a picture of it? Two to one it was as foggy as an artistic photograph and just as useless. After you have tried to pick the details out of one or two of these smoke-screens, you begin to realize the value of an imagination like the chief clerk's card index for details and as good at assembling as Henry Ford's factory. Such imaginations only come from hard training and are scarce enough to be valuable.

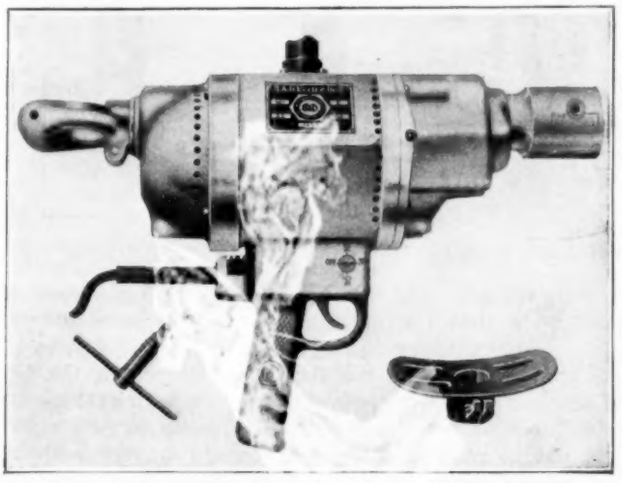
New tools are coming in at a rate which shows that something is stimulating the designer's wits. It is a good sign and leads us to believe that when the manufacturers hear the howl raised by necessity they will be there with the machines to relieve the itch. The howl has already started and is increasing daily in volume. Listen and answer.




# SHOP EQUIPMENT NEWS

## Black & Decker ½-Inch Electric Drill

The Black & Decker Manufacturing Co., 105-115 South Calvert St., Baltimore, Md., is now marketing a ½-hp. electric portable drill for holes up to ½ in. in diameter. The full-load current consumption is about 700 watts, and the no-load speed, 600 r.p.m. The housing is of aluminum alloy completely inclosing the motor and gears, and the total weight is 21½ lb. It is equipped with the Black & Decker pistol grip and trigger switch, the arrangement enabling the operator to control the drill without changing the position of his hands. An indicator is provided showing when the switch is on or off. The motor is of the series-compensated wound interpolar type, and uses direct current or alternating current of 25, 40 or 60 cycles. The machine will operate from any two wires of a three-phase circuit. The motor is air cooled by a fan mounted on the armature shaft which draws in air at one end of the motor and expels it at the other. The gears are of high-carbon steel mounted on ground shafts and operate in grease in a separate grease-tight compartment. The drill spindle runs in a bronze bushing, thrust being taken by a ball-thrust bearing. The commutator end cover is entirely separate from the armature shaft bearing and can be easily removed for inspection or adjustment of the brushes, this also eliminating the possibility of the armature shaft binding in its bearings in case the end cover is accidentally distorted by dropping the drill.

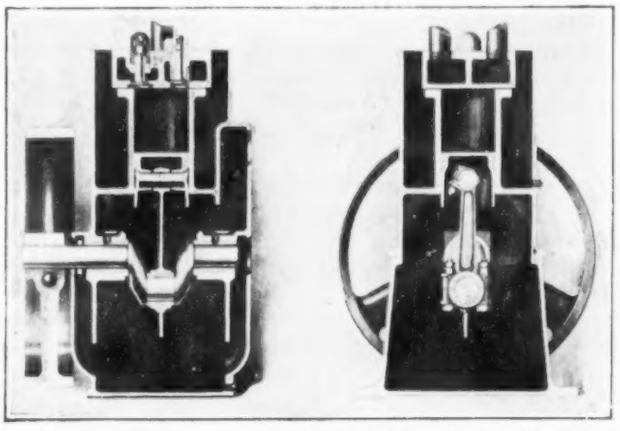


BLACK & DECKER PORTABLE ELECTRIC DRILL

Horsepower of motor, ½; capacity, holes up to ½ in. in diameter; current consumption, 700 watts; no-load speed, 600 r.p.m.; weight, 21½ lb.; current used, either direct or alternating of 25, 40 or 60 cycles.

## Ingersoll-Rand Air Compressor

The Ingersoll-Rand Co., 11 Broadway, New York, has recently placed on the market a line of four new air compressors, ranging in sizes and capacity from 3 to 45 cu.ft. of air per min. at a pressure of 100 lb. per sq.in. The small-size compressor can be used for pressure requirements up to 200 lb. per sq.in. if desired. The machines are single-acting, vertical type, belt driven or motor driven as desired. They are said to be so balanced as to operate satisfactorily if bolted to any solid flooring. The smallest size is built for either air or water cooling, the former being for intermittent service, while the larger machines are built for water cooling only, employing a reservoir-jacket system. The



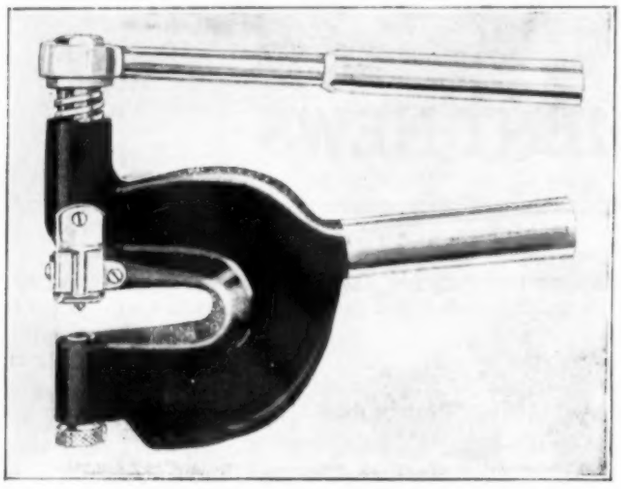
CROSS-SECTION VIEWS OF THE INGERSOLL-RAND AIR COMPRESSOR

Sizes, 2½ x 3 in., 3½ x 4 in., 4½ x 5 in., and 6 x 6 in., the smallest size being made either air or water cooled, the other three sizes being made in water-cooled styles only. Capacities, 3 to 45 cu.ft. of air per min.

largest machine is also built with a closed jacket for the pressure circulation of water. The crankshafts and connecting-rods are drop-forged while the bearings are die cast and removable in case of wear. Lubrication is by the automatic splash system.

## "Jiffy" Hand Punch

The "Jiffy" metal punch shown in the illustration is for use on sheet metal and will punch holes $\frac{5}{32}$, $\frac{3}{16}$, $\frac{7}{32}$ or $\frac{1}{4}$ in. in diameter in metal up to 10 gage thick. The weight is 5 lb. and the over-all length is 9½ in. The throat is deep, allowing holes to be punched at a

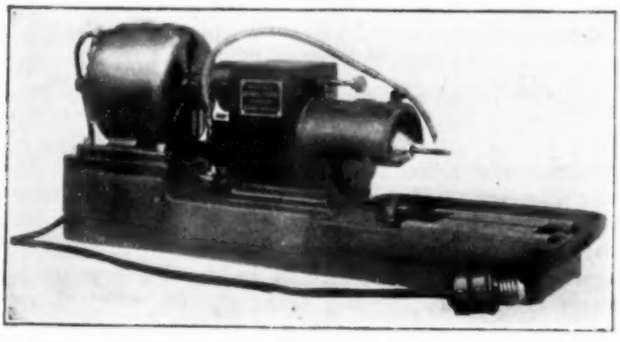


"JIFFY" HAND PUNCH

considerable distance from the edge of the sheet of metal, and a one-piece automatic disappearing stripper is used, giving a clear view of the punch mark, as well as permitting a number of sheets to be punched at one operation. The punches are of the crowned floating type, a feature that is said to greatly reduce punch breakage. The punch is driven through the metal by one-half a turn of the lever handle. Paul W. Koch & Co., 19 South Wells St., Chicago, Ill., is the manufacturer.

## Bicknell-Thomas Tapping Machine

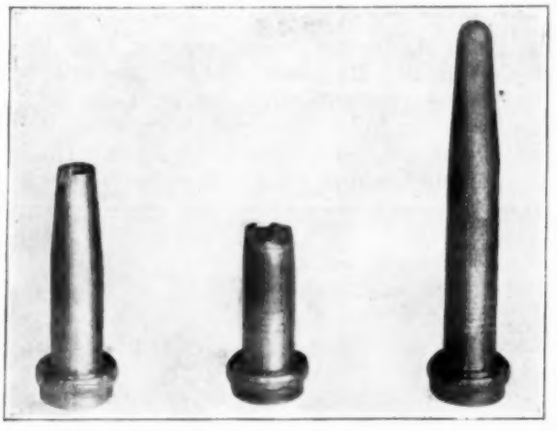
The Bicknell-Thomas Co., Greenfield, Mass., has just placed on the market a new bench type tapping machine that is rather a distinct departure in tapping-machine design. It is compact, and there are no protruding parts to catch the fingers or clothing. It has a cone friction driving mechanism which, it is said, enables the operator to tap to the bottom of a hole without danger of breaking the tap, and also enables the operator to tap a larger number of holes than are generally completed. The device has a two-speed geared transmission that is said to be noiseless. This runs in grease which serves to lubricate all parts of the machine except the motor. All spindles are hardened and ground and the main spindle runs on ball bearings. The table slide, which is made to hold suitable work-holding fixtures, has ball bearings, making it sensitive in operation, and has an adjustable stop for the table. The machine is furnished either with or without oil pump and piping. It is stated that the machine has tapped as many as twenty-four $\frac{3}{16}$-in. holes per minute.



BICKNELL-THOMAS MOTOR-DRIVEN TAPPING MACHINE

## Milburn Oxyacetylene Cutting and Welding Tips

The illustration shows cutting and welding tips that are now being marketed by the Alexander Milburn Co., Baltimore, Md., the advantages of which are that the same torch with a change of tip can be used for both cutting and welding. The tip at the left is the cut-



MILBURN WELDING TIPS FOR WELDING AND CUTTING

ting tip while that at the right is the welding. Another feature is that the cutting tip can be burned back considerably without destroying the cutting qualities of the flame. To prove the foregoing statement, the tip in the center was purposely burned back in cutting an 8-in. piece of steel, after which the tip at the right was put in place and the piece again welded without cooling off. It is also claimed that it is impossible for these tips to backfire.

## Newton Duplex Locomotive Connecting-Rod Boring Machine

The machine shown in the illustrations is primarily intended for the boring of locomotive connecting-rods, but it is also applicable for the production of many other parts that require heavy drilling, such as cross-heads, etc. The machine is the product of the Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Penn., and its particular advantages are summarized as follows: (1) The machine utilizes newly developed cup cutters which dispense with the necessity of drilling pilot holes for boring bars, this feature being said to conserve drills, material, time and power; (2) the kerf by the cup cutters in no case exceeds $\frac{3}{8}$ in.; (3) the cores are removed solid and have an

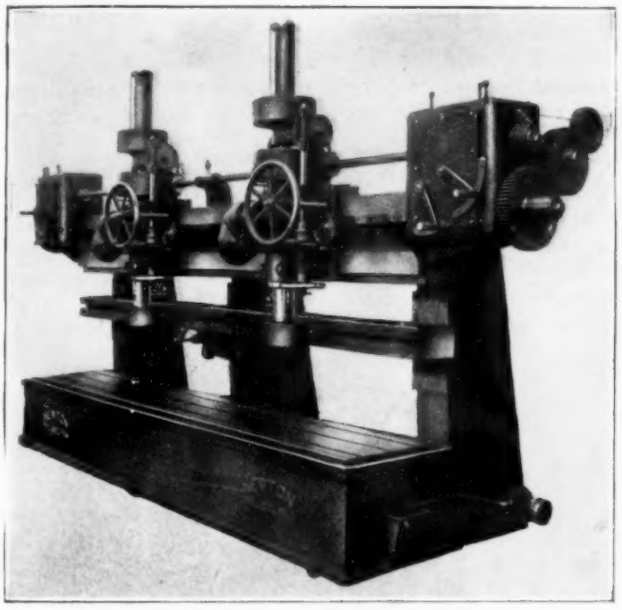


FIG. 1. NEWTON DUPLEX LOCOMOTIVE CONNECTING-ROD BORING MACHINE WITH SPEED BOXES

Diameter of spindle, 4 in.; diameter of spindle nose, 5¼ in.; length of automatic feed for spindle, 16 in.; minimum distance between spindle centers, 30 in.; maximum distance between spindle centers, 11 ft. 4 in.; maximum distance from top of table to end of spindle, 25½ in.; distance from center of spindle to upright, 17½ in.; work table, 24 in. x 13 ft. 6 in.; Morse taper in spindle, No. 7; distance between spindle centers with auxiliary table, 14 ft. 5 in.; distance from spindle to surface of auxiliary table, 50 in. maximum, 34 in. minimum.

increased salvage value; (4) a lower support that makes the above economies possible; (5) two ends of one, or one end of two rods may be bored at the same time; (6) the two spindles allow the duplication of center distances in like rods; (7) cross-heads can be reamed advantageously; (8) a new speed box, by means of which speeds may be controlled by levers without a change of gears, and (9) adaptability for odd jobs of heavy drilling.

Fig. 1 shows the machine with the speed box in place, while Fig. 2 shows one end of the machine and the auxiliary table. The base consists of a large casting, the top surface of which, after being finished and slotted, is used for the working surface. This surface is surrounded by an oil pan cast integral with the base. The box-type rail, which is ribbed internally, is attached to the base by means of three uprights. The spindle saddles have angular bearings on the bottom section of the rail to give close contact under heavy pressure, while the top bearing is square, adjustment being made by a bronze taper shoe on the top and rear by a gib bolted to the saddle. The saddles may be held at any position on the rail and are adjusted by a pinion, the solid end of which is squared to fit a removable ratchet handle.

The spindle turns in the sleeve in bushed bearings and has a Morse taper and drift and retaining key slots. The drive is through worm gearing, the wheels having bronze rings with teeth of steep lead, while the worms are hardened steel fitted with roller thrust bearings. The spindles are incased for lubrication purposes and the section fitting the rack sleeve revolves in bronze bushings. The upper ends of the spindles and rack sleeves are protected from dirt by covers serving as a support for the counterweights. A feature of the design is that the thrust of the driving worm is carried on a bearing cast integral with the saddle.

The feed is through spiral gears, one of which is mounted on the spindle sleeve while the other is keyed to the horizontal pull-pin shank on which are also mounted four pull-pin gears, giving four changes of feed which are transmitted to the rack sleeve through a worm and worm wheel. This motion is clutched by means of a cone friction permitting both power and hand elevation. The saddles have hand adjustment on the rail. The auxiliary or lower support for the spindles has a bearing on each upright and also hand elevation by means of a worm and wormwheel. This bearing supports the spindle at the lowest possible point and prevents distortion.

The auxiliary side table shown in Fig. 2 is used for reaming cross-heads. The in-and-out adjustment of this table is supplemented by the longitudinal adjustment of the spindle over the table, thus permitting the clamping of work without having to locate to the actual center. These adjustments also permit the drilling and boring of a series of holes on varied centers at one setting. T-slots are incorporated in both the vertical and horizontal faces, to permit clamping as most convenient. The rail is extended to carry the spindle center 18 in. beyond the vertical face of the auxiliary table, giving a maximum distance between centers of the spindles of 14 ft. 5 in. The side table is placed low to allow for the extra height of work, the distance from the top of the table to the spindle end being 50 in. maximum and 34 in. minimum.

The speed boxes shown in Fig. 1 are for use with constant-speed motors and single-pulley drive, allowing for changes of speed by means of sliding sleeves without the removal of gears. Each spindle is under the control of its own speed box, permitting suitable speeds when the spindles are boring holes of different sizes.

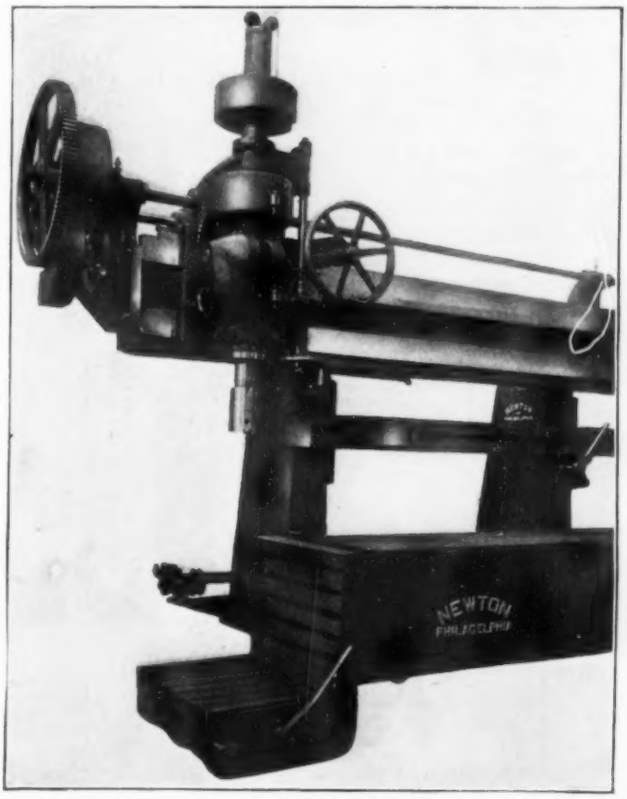
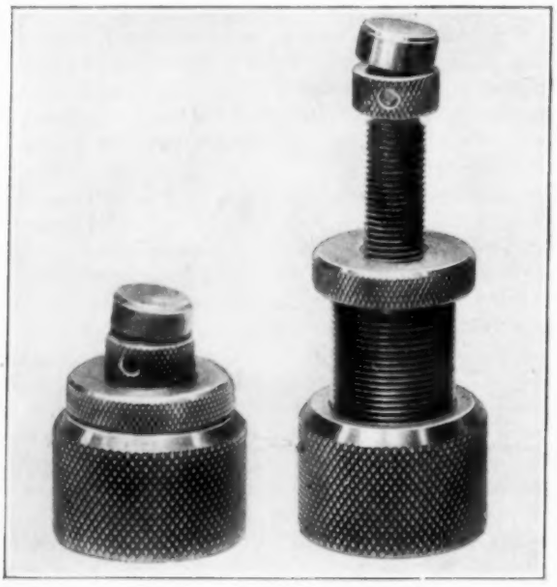



FIG. 2. THE END OF THE CONNECTING-ROD BORING MACHINE SHOWING THE AUXILIARY TABLE FOR CROSS-HEAD WORK

## "Hi-Lo" Jack

The Harvard Machine Co., Harvard Square, Cambridge, Mass., has recently placed on the market the "Hi-Lo" jack shown in the illustration. This has a range of adjustment from 2 to 4 in. and requires very

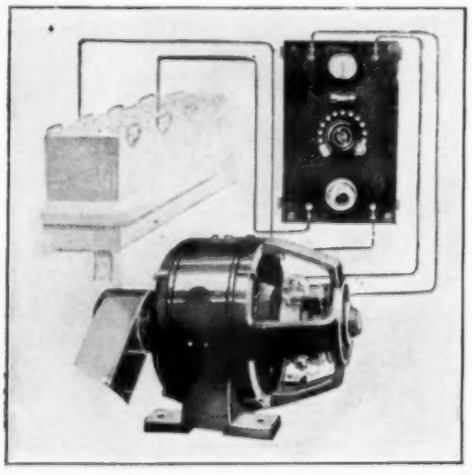


"HI-LO" ADJUSTABLE JACK

little space in the tool case. By removing the top screw it is said to be useful in drilling parts requiring a support directly beneath the drill, as it allows the drill to go through. The top piece is secured in place but is free to adjust itself to uneven surfaces. All parts are made of steel and hardened.

## Hobart Battery-Charging Outfit

The illustration shows a new battery-charging outfit that has been recently placed on the market by Hobart Brothers Co., Troy, Ohio. This is made for charging the storage batteries of industrial tractors, or the storage batteries of automobiles, and can also be used for regular electric-lighting work, if desired. The generator is wound for the desired voltage, direct current, and runs at a speed of 1800 r.p.m. The weight is

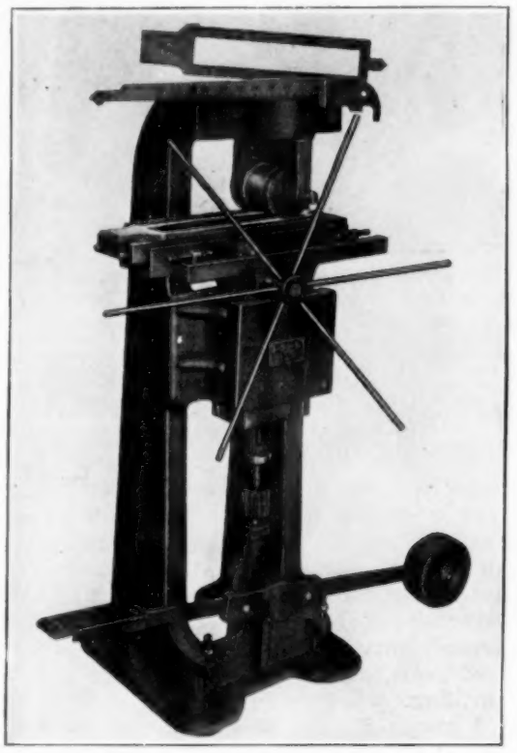


HOBART STORAGE-BATTERY-CHARGING OUTFIT

300 lb. It is intended to be operated from a lineshaft or engine and requires approximately 4 hp. at full load. The outfit includes generator, base tracks, field rheostat, charging panel and pulley with 6-in. diameter and 4-in. face, no switchboard being necessary.

## Noble & Westbrook Marking Machine

This machine is for impressing the graduations and figures on scale beams or other long work of similar character, and is a recent product of the Noble & Westbrook Manufacturing Co., Hartford, Conn. It is claimed that the machine is simple, accurate, easy to



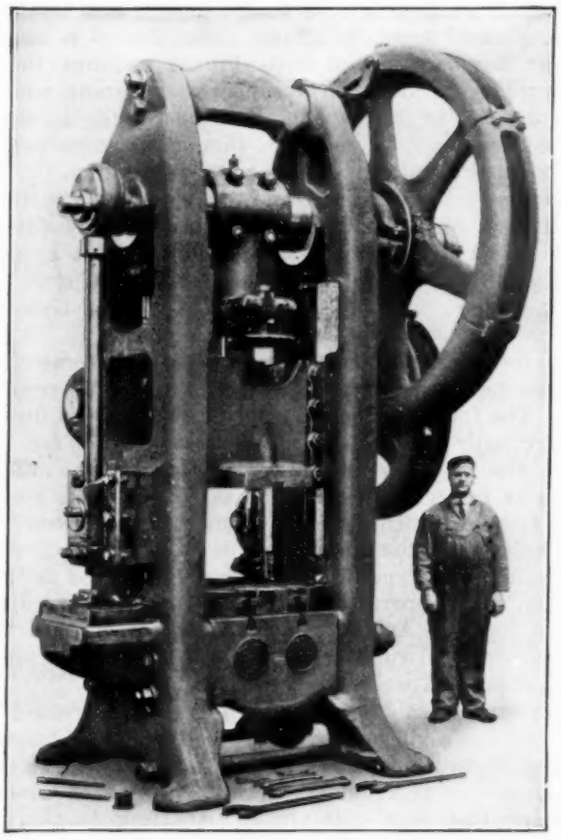
NOBLE & WESTBROOK MARKING MACHINE

operate and that it is a great saving to the manufacturer over other methods of graduating this class of work. The work to be marked is held on the table by a suitable fixture, the die being cylindrical. The die is carried in a yoke or holder, and is connected to a cut gear meshing with a rack. The marking is performed by pressure applied to the foot lever, and an adjustable cam regulates the depth of the impression, so as to make this uniform on the various pieces of work.

## Ferracute Trimming Press

The press shown in the illustration is a recent product of the Ferracute Machine Co., Bridgeton, N. J., and is said to contain a number of new features. It exerts a pressure of 200 tons and is provided with a side punch exerting a pressure of 50 tons. A pair of shearing dies is shown set in the side press, which has a stroke of 3 in., the stroke of the ram of the main press being 6 in. Motor drive is furnished, the motor being mounted on a shelf and the drive being through a rawhide pinion engaging teeth on the rim of the flywheel, which weighs one ton and has a speed of 183 r.p.m., producing 20 strokes per min. of the press.

Steel gearing is used, the larger gear being 78 in. in diameter with 9-in. face. The flywheel and gears are guarded, the guards being made in sections composed of woven wire, the edges of which are cast into an iron frame. The diameter of the steel shaft at the journals



FERRACUTE TRIMMING PRESS

is 7½ in. and at the crank 9 in. The adjustment of the main ram downward from top position is 5 in., and of the side-punch ram, 3 in. The total height of the machine is 13 ft., and the weight, 39,500 lb. The machine is started and stopped by means of a pin clutch, pressure on the treadle causing the press to make one stroke, at the completion of which the ram automatically stops at its hignest position.

## "Seminole" Chisel Steel

The Ludlum Steel Co., Watervliet, N. Y., has recently developed and placed on the market a new chisel steel known as "Seminole." It is stated that this new alloy chisel steel can be made so hard that it will cut glass, yet may be bent by being hammered over the edge of an anvil. It is claimed that the steel is almost fool-proof in hardening and has a very wide temperature range, this being from 1650 to 1950 deg. F. The steel is quenched in oil and slightly drawn. The drawing does not seem to affect the hardness but assists in producing toughness.

Fig. 1 shows a spike made of this steel that has been driven through a piece of low-carbon steel and has curved slightly as it passed through the bar, yet the spike was not broken. Fig. 2 shows a chisel that has been driven through a slab of steel and still remains unbroken and with the edge undamaged. It is also

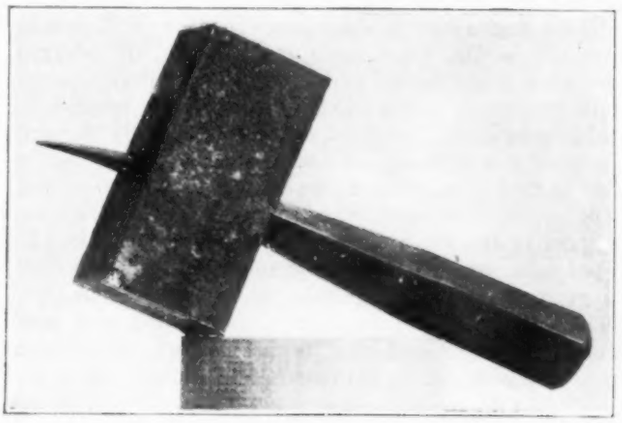


FIG. 1. A SPIKE OF "SEMINOLE" CHISEL STEEL DRIVEN THROUGH A LOW-CARBON STEEL BLOCK

stated that in the case of chisels made of this steel the head will mushroom somewhat but will not chip off. It is said the steel is very peculiar metallographically and that it seems to have a very fine structure that is quite difficult to define in the usual nomenclature of the metallographist.

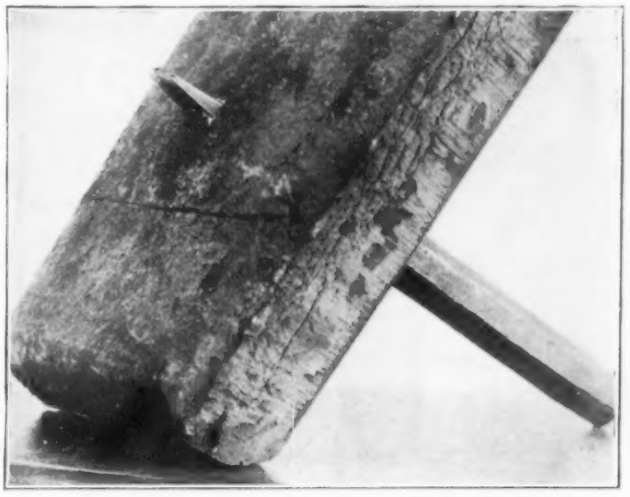


FIG. 2. A CHISEL DRIVEN THROUGH CARBON STEEL AND SHOWING NO SIGNS OF BENDING OR BREAKING

## American Radial Drilling Machines

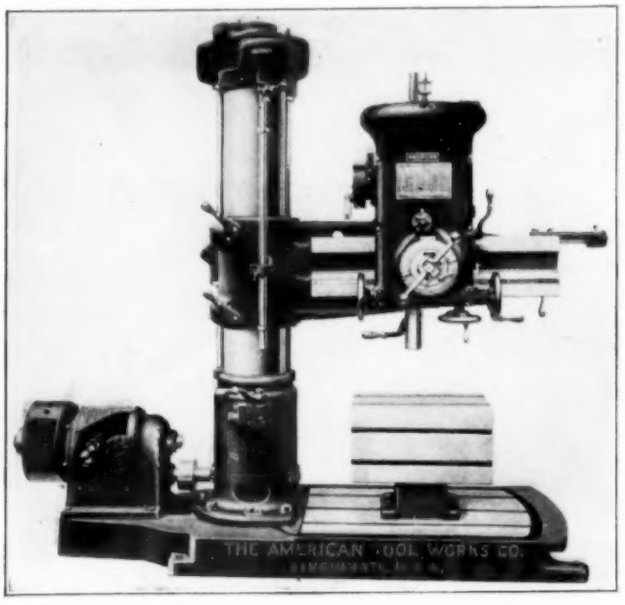
The radial drilling machine shown in the illustration is made in two sizes, 3 and 3½ ft., and is a recent product of the American Tool Works Co., Cincinnati, Ohio. It is known as the company's "Triple-Purpose Radial," it being stated that features have been added that make it not only useful in drilling and tapping, but also in boring. The machine is intended for heavy work, and it is recommended that at least 9 hp. be delivered to the speed box through the belt on a belt-driven machine, while a motor not less than 7½ hp. is recommended for motor drive.

The head is quadruple geared, these four distinct speeds being in turn divided into two separate ranges of speed, one for heavy tapping and boring, while the other is for high-speed drilling and light tapping. The boring and tapping range in conjunction with the six-speed gear box gives 12 speeds from 30 to 134 r.p.m.

obtained through an internal gear drive on the spindle, while the high-speed drilling range consists of 12 speeds from 155 to 700 r.p.m. obtained through an external gear drive, the internal and external gear drives being non-interfering. These 24 spindle speeds are in geometrical progression. The head mechanism is fully inclosed in a casting or housing. A feature of the double-spindle drive is that it allows a range of speed from 30 to 700 r.p.m. without encountering excessive gear velocities. No gear in the machine has a speed greater than 875 ft. per min., which is said to be considerably lower than the gear speed on most machines of similar type.

The entire tapping attachment is inclosed and runs in oil. Gears are semi-steel, bronze-bushed, the friction bands being 4¾ in. in diameter and adjusted from the outside.

It is stated that the machine is very simple and convenient, and that it does not contain a multiplicity of parts in consequence of the added speeds. Only 14 gears are used in the speed-changing mechanism to obtain the 24 spindle speeds. The controlling levers on the heads




AMERICAN 3- AND 3½-FT. TRIPLE-PURPOSE RADIALS

Specifications for 3-ft. machine: Maximum distance from spindle to base, 53 in.; spindle speeds, 24, 30 to 700 r.p.m.; range of feeds, 0.004 to 0.026 per spindle revolution; taper in spindle, Morse No. 4; drills to center of circle outside of column, 72 in.; traverse of spindle, 12 in.; traverse of head on arm, 28 in.; traverse of arm on column, 28 in. Specifications for 3½-ft. machine: Maximum distance from spindle to base, 53 in.; spindle speeds, 24, 30 to 700 r.p.m.; range of feeds, 0.004 to 0.026 per spindle revolution; taper in spindle, Morse No. 4; drills to center of circle outside of column, 84 in.; traverse of spindle, 12 in.; traverse of head on arm, 34 in.; traverse of arm on column, 28 in.

are located within reach of the operator, and two head-moving wheels are provided, one on each side, so that the operator can use either as most convenient. In order to allow the arm to be swung easily a conical roller bearing is placed between the column and sleeve at the bottom, while at the top a ball bearing is interposed to take the radial thrust.

All gears in the machine are made of steel with the exception of the gears on the cap, tapping attachment, arm miter gears and main spindle gear which are of semi-steel, and a few feed gears which are of manganese bronze. The pinions and clashing gears in the speed-changing mechanism except for the large internal gear are heat-treated and hardened. All shafts in the head and gear box are of crucible steel, while the long vertical and horizontal shafts are made of 45-point carbon steel ground to size. Every cylindrical bearing is renewable and bushed with phosphor bronze.

Another feature of the machine is the centralized lubrication system. The oil ducts are brought to centralized locations on the head and cap, this method insuring an oil supply to all bearings. The oil is led to annular chambers formed in the bronze bushings, these chambers containing a large supply of lubricant, which is in turn fed to the bearings by strips of felt in slots cut lengthwise in the bushings, this construction being said to insure uniform supply without flooding.

Another feature is the counterweight construction which is completely inclosed by the head casting. It is stated that the movement of the head along the arm is facilitated by the counterweight being built close in to the spindle, bringing the center of gravity close to the head support on the arm.

The feeding mechanism gives six feeds in geometrical progression from 0.004 to 0.026 in. per spindle revolution. The indicating mechanism of the feeds is direct reading, only one dial being required, on the face of which the respective feeds are indicated. The mechanism is protected against shocks or excessive stress by a friction which forms the connection between the mechanism and the spindle. This is of the improved expanding-band type, quickly adjustable to the desired tension, and is operated by two levers known as quick-return levers. Another important point is that the feed wormwheel runs in an oil bath to insure a minimum amount of wear.

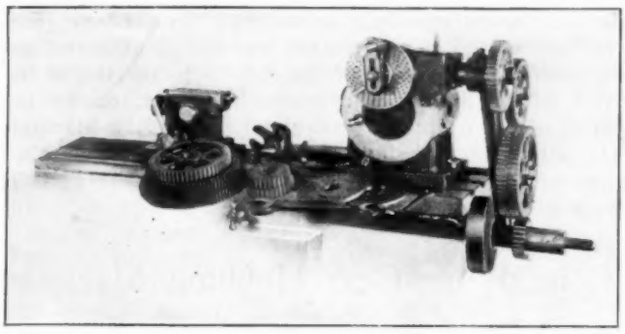
The arm is said to have been greatly increased in size and has a rib or web at the bottom. The bearing area of the arm girdle is said to be unusually great, and the improved arm binders permit the use of a solid girdle instead of a split girdle. A safety friction incorporated in the elevating gear prevents the arm from being elevated until the binders are loosened. It is also impossible to raise the arm above or below fixed points. The friction also eliminates the shock that generally takes place when the elevating gears are engaged. The elevating mechanism is controlled by a lever which is inoperative until a safety knob is released, thereby guarding against breakage caused by careless handling.

The speed box which furnishes six changes of speed is of the cone and tumbler type and has an automatic silent clutch auxiliary drive that keeps the shafts and gears running while the changes are being made, this system eliminating the shock caused by the engaging of the gears. This drive is used during speed changing only, and never for a working speed. The gears of the tumbler mechanism are cut with 20-deg. cutters, and later carbonized and hardened, the pointed teeth facilitating the engagement of the gears. A spring shock absorber is located between the speed box and column driving gears to lessen the wear and tear on the mechanism.

A ledge is regularly provided on the base to accommodate the auxiliary support which swings as the arm is moved. The machine is furnished with a separate, plain, box table as shown in the illustration, but if desired can be equipped with a swinging box table or a worm swiveling and round table, it being possible to rotate this latter in a complete circle by means of an inclosed worm and wormwheel, a mechanism also being provided to tilt the table at any desired angle.

## Simmons Universal Index Heads

The Simmons Machine Co., Inc., Albany, N. Y., has recently placed on the market the universal index heads shown in the illustration, which are designed to swing work up to 10 in. in diameter. The swivel block is graduated and can be adjusted to any angle from 10 deg. below horizontal to 10 deg. beyond perpendicular,



SIMMONS UNIVERSAL INDEX HEADS

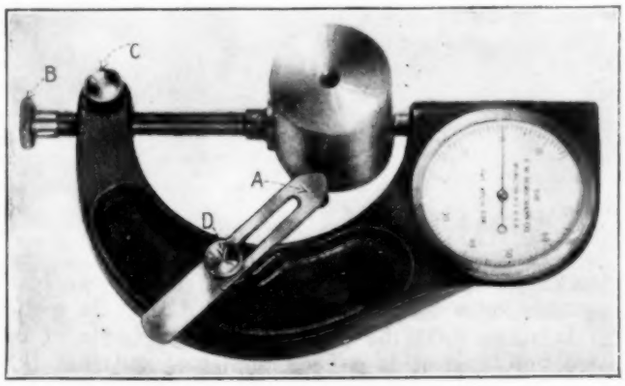
Taper in spindle, No. 10 B. & S.; hole through spindle, 1 1/8 in.; threads on spindle, 2 5/8 in. in diameter, threaded, 6-pitch right hand; swivel, from 10 deg. below horizontal to 10 deg. beyond perpendicular; diameter of wormwheels, 5 in.; gears, 3/4 in. thick, 1 1/4 in. bore; weight, 150 lb.

and by removing the extension arm the head can be swung 90 deg. The index crank is adjustable and all bushings are hardened. Equipment includes three index plates, gears, four 5/8-in. bolts, driving dog, wrenches, index chart showing every division obtainable up to 360 deg., and also a spiral chart.

## Horstmam Indicating Clippers

The F. W. Horstmann Co., of 210 Coit St., Irvington, N. J., has placed on the market an indicating caliper or dial comparator which is designed to take the place of the snap gage to some extent. It is claimed for this tool that work can be more quickly gaged, and that inexperienced operators may use it as readily and rapidly as the more experienced ones.

Where it is desired to gage quickly a number of round pieces as in regular production of turned parts from the lathe or screw machine, the stop *A* is set to allow a standard plug gage of corresponding size to enter the proper distance between the measuring points to gage the maximum diameter; that is, to bring the gaging points diametrically opposite in relation to the center of the plug. The screw *B* is then turned until the pointer indicates 0 on the dial.




HORTSMANN INDICATING CALIPER

Clamping screws *C* and *D* are now tightened and the tool used in the same manner as a snap gage except that the work will enter the gage readily if it is within 1/2 in. of correct size, and a glance at the pointer will show immediately not only whether the work is too large or too small, but will indicate in thousandths of an inch the amount of the variation.

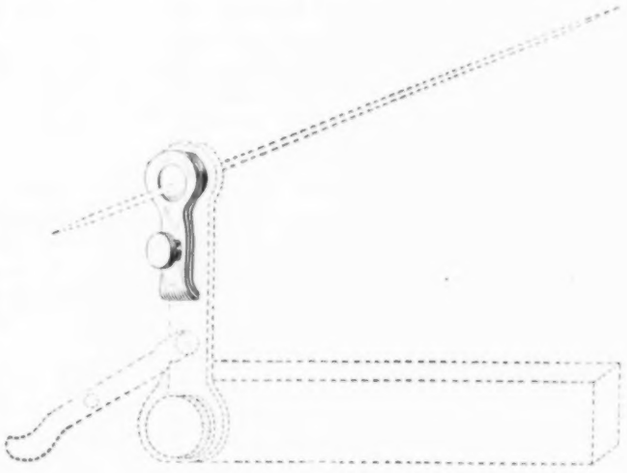
Positive stops are provided on the gaging spindle so that the indicating mechanism cannot be injured by forcing the gage onto a piece that is too much over size. There is no possibility of variable readings by different individuals because of difference in the sense of touch as the measuring pressure is always applied by the tension of the indicator spring.

The indicator movement is through a compound lever, segment and pinion, the spiral spring tending at all times to hold the parts in contact in one direction so that there is no liability to error through backlash or lost motion.

The tool is made in all sizes from 1 to 12 in. and weighs very little more than a micrometer of corresponding size.

## Horstmann Indicating Clippers

T. Daniel Bush, 119 South Center St., South Allentown, Penn., has just placed on the market an attachment to be used in connection with the universal

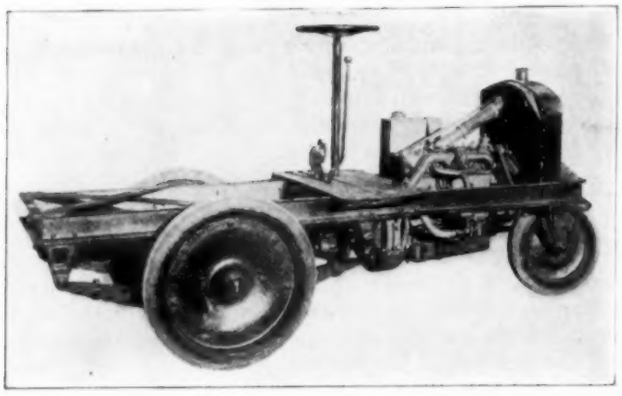


NEW ATTACHMENT FOR BUSH UNIVERSAL INDICATOR

indicator described on page 419. This attachment allows the ball-headed needle to be reversed and is said to be very convenient for some classes of work.

## Clark "Tructractor"

The "Tructractor" shown is a recent product of the Clark Tructractor Co., 80 East Jackson Blvd., Chicago, Ill., and is intended for use where the combined features of a truck and tractor are desired. As a truck it will carry a load of 1½ tons and as a tractor will haul a number of loaded trailers. It turns in a radius of 6 ft. and is mounted on three single-piece metal disk wheels with roller bearings on the front wheel and annular ball bearings on the two rear wheels, the tires being of the solid pressed-on type. The motor is a four-cylinder with internal gear-driven axle; dry plate, multiple disk, non-adjustable clutch; selective type transmission, three speeds forward and one reverse;



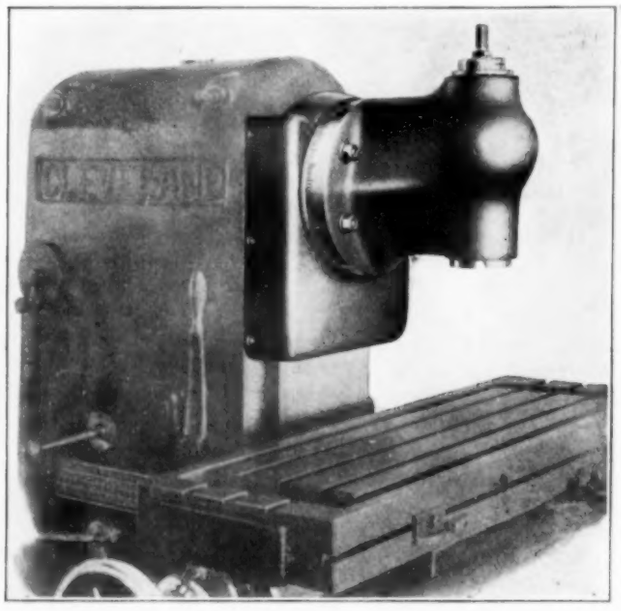
CLARK "TRUCTRACTOR"

Load carried, 1½ tons; turning radius, 6 ft.; motor, four-cylinder, 3¼ x 4½; drive, internal gear; clutch, dry plate, multiple disk; transmission, selective, three speeds forward, one reverse; gasoline feed, gravity; steering gear, worm and sector type; weight, with standard body, 2050 lb.; wheel base, 72 in.; tread, 35½ in.; over-all length, 112 in.; over-all width, 42 in.; height of platform above ground, 28 in.; speeds, 1 to 15 m.p.h.

and standard automobile control. The gasoline is fed by gravity. The steering gear is of the worm and sector type. Speeds obtained on these trucks are from 1 to 15 miles per hour.

## Cleveland Vertical Milling Attachment

The Cleveland Milling Machine Co., 18511-18517 Euclid Ave., Cleveland, Ohio, has recently placed on the market the vertical-spindle milling attachment shown in the illustration. This attachment is made for the Nos. 1, 2 and 3 machines made by this company.



VERTICAL SPINDLE MILLING ATTACHMENT

Specifications for a No. 1 machine: Distance from face of column to center of vertical spindle, 10¾ in.; distance from nose of spindle to table, 1¼ to 16¼ in.; cross range of machine, 8 in.; longitudinal range of machine, 22 in.; taper hole in spindle, No. 10 B. & S.; weight, 200 lb.

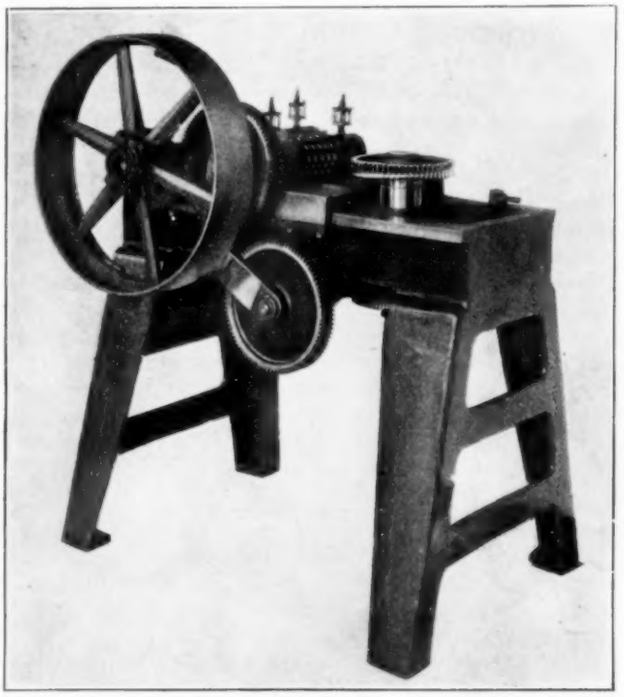
Specifications for No. 2 machine: Distance from face of column to center of vertical spindle, 12⅛ in.; distance from nose of spindle to table, 1¼ to 16¼ in.; cross range of machine, 10 in.; longitudinal range of machine, 28 in.; taper hole in spindle, No. 11 B. & S.; net weight, 245 lb.

Specifications for No. 3 machine: Distance from face of column to center of vertical spindle, 15 in.; distance from nose of spindle to table, 2 to 18¼ in.; cross range of machine, 12 in.; longitudinal range of machine, 34 in.; taper in spindle, No. 12 B. & S.; weight, 350 lb.

The drive is taken from a gear fastened to the nose of the spindle, which in turn drives the spur gear on the horizontal shaft, and the spindle is in turn driven by miter gears. All gears and shafts are made of steel, are inclosed and run in bronze bearings throughout. The bearings on the spindle form two taper cones in opposite directions, and are adjusted by a nut outside of the spindle. The base of the head is graduated so that it may be set to any angle in a vertical plane parallel to the elevating screw, and the distance from the face of the column to the vertical spindle and the distance from the nose of the spindle to the top of the table in its highest and lowest positions, covers the range of the ordinary vertical-spindle milling machine. The attachment is clamped in position on the dovetail slide of the column and is said to be as rigid as if it were a part of the machine.

## Cone Worm-Gear Hobbing Machine for Production Work

The Cone Automatic Machine Co., Inc., Windsor, Vt., has recently placed on the market the machine illustrated, which is for hobbing worm gears on a production basis. The machine is primarily intended for use on gears up to 18 in. in diameter, but can cut gears up to 24 in. in diameter in an emergency. The blank to be cut is attached to the upper end of the vertical spindle at the right, while a master gear is mounted on the lower end of the spindle, this being driven from a master worm mounted on the horizontal shaft which is in turn driven through a system of gearing from



CONE WORM-GEAR HOBBING MACHINE

the cutter spindle. The cutter is fed into the blank, suitable stops being provided for limiting its motion. It is stated that the machine is very simple in construction, that it is a good producer, and that there is little chance to go wrong in setting up the work.

# War Factors Affecting Mechanics

By C. E. Shaffner

That the transition from war to peace production in the factory and the shop is characterized by a changed attitude on the part of mechanics generally toward modern production methods seems quite apparent and is largely due to a broader sense of correlation to which several factors engendered wholly by the circumstances of the war have especially contributed.

When there was a good deal of hurrying and scurrying about in our war preparations, the writer heard an efficiency engineer in a middle western factory engaged in making cannons say to his associates: "Pay no attention to what any one tells you. Simply go ahead and get the results we want and the information we need." At the time foremen throughout the plant were openly disregarding any attempt to maintain production records and an adequate system of routing. Here was a situation whereby two departments of vital importance to each other were setting up tangles and difficulties rather than the proper coöperation. As a matter of fact the hindrance of production was the last thing in their minds but because of petty differences they were accomplishing the same results as if they had purposely planned to hold up the work. At the same time it is undoubtedly safe to say that for some months before the armistice was signed there was little evidence of any such attitude on the part of the mechanics. Aside from motives and feelings prompted by patriotism there were other considerations which brought the man engaged in production work in closer contact with the other departments of the plant and to measure of understanding as to their actual needs and purposes never before attained.

From observations at first hand which the writer was in a position to make it seems that two factors were chiefly responsible for this more complete understanding on the part of the man in the shop and these were: The induction into the shop and factory of men from other walks of life; and the increased capacities and vision of foremen in particular and of all mechanics to a considerable extent. In several ways at least these two factors are so closely related that their effect is best described briefly by general illustrations showing how they operated as complementary forces. In this connection I recall that one day last winter a bench foreman in an ordnance plant seized a box of small parts for cannons and carelessly emptied them into a larger receptacle even though each lot was carefully marked with a shop tag. "What's the difference?" he shouted. "All of them are operating slide liners and why shouldn't we have them together?" At the end of that particular shift he was no longer foreman in charge of that work; not only because he had openly disobeyed instructions but also on account of the feeling he had stirred up among the men in his charge who understood thoroughly why these gun parts should be separated and therefore had a particular interest in seeing that no unnecessary tangle should be introduced into the process of production which could be charged to carelessness of some of them.

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Ding in New York Tribune.

# Sparks from the

## Can Export Metal Goods to England

**Restrictions Placed on Machine Tools and Metal Goods by the British Government Are Reported Removed**

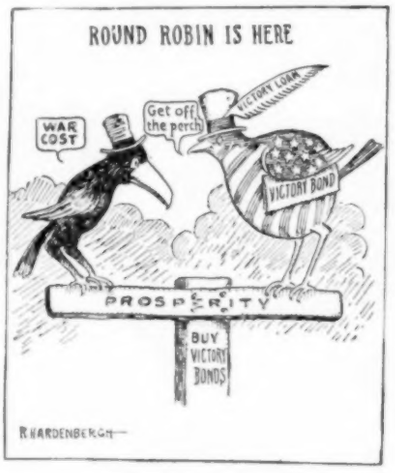
According to a cable received in Washington from Consul General Skinner, the British Government has removed the embargo against imports from the following important items: Belt hooks for machinery and sewing machines, bolts and nuts, enameled steel tanks with glass linings, heddle steel strip iron, hook strip, tube strip, and ground flat steel stock; machine tools and parts, tools and appliances and parts, namely, abrasive wheels, adjustable clamps, anvils, auger bits, bench drills, bolt clippers, boring heads, calipers, carpenters' tools, chasers, chucks, cooper tools, cutting nippers, dial gages, dies and die stocks, die heads, drills, drill presses, drill sleeves and sockets, emery-wheel dressers, engineers' hammers, expanding mandrels, expansion bits, farriers' tools, furniture and dovetail bits, gaged glass cutters, hacksaw blades, hand and breast drills, hand grinders, hand screwing machines, hide hammers, iron hammer heads, joiners' tools, lathe carriers, lathe dogs, lead hammers, machine vises, masons' tools, measuring tapes and rules (except wooden rules) and including verniers, micrometers, milling cutters, miter blocks and scrapers, blocks and scrapers for metal miter boxes, nail pullers, pipe cutters, pipe vises, pipe wrenches, pliers, polishing heads, punches, reamers; saws—band, circular, crosscut, kitchen and others; screwing tackle (i.e. chasers, dies and stocks, taps, and threadmilling cutters); shipwrights' tools, slide rules of metal, smiths' tools, spanners, swage shapers, tailors' shears and trimmers, 6 in. or more in length, tapping attachments, taps, tap wrenches, tool holders, trench struts, tube expanders, upholsterers' or household hammers, welt plows, deacon's wood-boring bits, woodscrapers, treadle lathes of 3-in. centers and over, wire hooks (other than coat and hat hooks), woodworking machinery and parts thereof. Solid drawn weldless tubing is to be admitted only in very special circumstances.

* * *

## Gives Post-Graduate Course to Tractor Demonstrators

A tractor-demonstration school was held at the Hart-Parr factory, Charles City, Iowa, on Apr. 23 and 24, for the purpose of affording a post-graduate course for salesmen and demonstrators who are already skilled in the operation of tractors. A special feature of the instruction was in giving plowing and general performance demonstrations for the benefit of the men in their respective sections of the country who will handle the tractor in competitive demonstrations.

The school also brought out points leading to economy of operation such as the saving of fuel and lubricating oils. Another feature largely brought out was coöperation between the factory and the field, and the possibilities of greater service all along the line from the factory, to salesmen and dealers, to the farmers and the buyers. About 50 salesmen from the field were in attendance.




This school differed greatly from the tractor schools held for the farmers and other buyers of tractors in that this was much more technical and broader in its scope. Some of the men in attendance came from considerable distance. A. W. Fitzpatrick, service manager of the Hart-Parr works, was the manager of the school and chief instructor.

* * *

## Consolidation of Sales Organizations of Ball-Bearing Companies

The products of the S K F Ball Bearing Co., Hartford, Conn., and New York; the Hess-Bright Manufacturing Co., Philadelphia; the Atlas Ball Co., Philadelphia, and the Hubbard Machine Co., Worcester, Mass., will be sold through one central organization, under the name of the S K F Industries, Inc., effective May 1. The officers of this new organization are as follows: B. G. Prytz, president; W. L. Batt, vice president; J. P. Walsh, comptroller, and S. B. Taylor, sales manager. The principal office will be at 165 Broadway, New York, with branches in Boston, Philadelphia, Atlanta, Buffalo, Cleveland, Detroit, Cincinnati, Chicago and San Francisco.

## Glenn B. Harris With Bureau of Standards

Glenn B. Harris, who for the past 15 months has been engaged in war work as mechanical engineer of the Ordnance Department, has resigned his position to accept an appointment with the Bureau of Standards of which bureau he has been made special representative with an office in the Engineering Societies Building, 29 West 39th St., New York.

During the time of Mr. Harris' service with the Ordnance Department he was in entire charge of master and inspection gages, having selection of design, supervision of procurement, inspection and distribution, and in this capacity handled more than $32,000,000 worth of this material.

Mr. Harris was responsible for the initiation of a gage shop at the Bureau of Standards, which salvaged gages rendered obsolete by revision in component drawings, and also for the manufacture of gages to meet emergency demands. This shop proved extremely valuable in expediting inspection of material for shipment overseas. He is a member of the American Society of Mechanical Engineers and was formerly of the editorial staff of the *American Machinist*.

* * *

## Hildreth in Charge of Machine-Tool Sales

Charles E. Hildreth has been appointed to take charge of the machine-tool section of the division of surplus property in the War Department. He served as a dollar-a-year man in the finished-products division of the War Industries Board and is intimately acquainted with the machine-tool business, being president of the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., and general manager of the National Machine-Tool Builders' Association. His appointment is the first step in the reorganization of the War Department machinery for the disposition of surplus machine tools.

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## The "Flivver" Airplane

"Flivver" airplanes that will carry two passengers and have a wing spread sufficiently narrow to make possible a landing on a county road are to be manufactured at the Maryland Pressed Steel Co.'s plant at Hagerstown, Md., according to reports.

The first plane of this type was witnessed by the July 4 gathering at Towson and is the invention of an Italian. It was the idea of the War Department to use the planes in France, but after the signing of the armistice the inventor was induced to work on a peace plane.

# World's Industrial Forge

*By E.C.Porter, News Editor*

## Fellows Gear Shaper Company Enlarges Plant

The Fellows Gear Shaper Co. of Springfield, Vt., has found it necessary to make further extensions to its plant, which was considerably enlarged during 1918 to take care of increasing business. The new plant which is to be built will consist of a shop of steel and brick construction, two stories high, the dimensions of which are 144 x 147 ft. This will increase the manufacturing capacity of the plant about 60 per cent. This company now employs approximately 450 men, and when the additional plant is in full operation the force will be increased to approximately 750 men.

In addition to the extension to the shop a new office of steel and brick construction will be built, the dimensions of which will be 42 x 102 ft. The entire top floor of the new office building will be occupied by the engineering and drafting departments, whereas the general offices will be located on the second floor.

The contract for this extension has been let to the New England Structural Co. of Boston, and it is estimated that it will cost between $200,000 and $250,000, not including equipment.

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## The Basic Industry on Which All Else Depends

The editorial supplement inclosed with this week's *American Machinist* presents very graphically the relation of the machine tool to modern industry. Industry depends primarily upon the machine tool, and the development, improvement and distribution of the machine tool must be encouraged by industry as a whole, as a step toward general prosperity.

* * *

## Executive Secretary Appointed for American Chamber of Commerce in London

George P. Toby, long connected with banking and industrial corporations in this country, has been appointed executive secretary of the American Chamber of Commerce in London and will sail for his new post about May 12, meanwhile conferring with American merchants as to the service which the American Chamber in London can render them.

Mr. Toby spent over a year in Washington during the war on work for the Treasury Department and on plans for coöperation between the various Government departments and the business world.

G. M. Cassatt, president of the American Chamber of Commerce in London, says: "The London Chamber wants to be used. What we most desire is that the individual American manufacturer, merchant, exporter, from one end of the country to the other, should learn to look upon us as an overseas service bureau of his own—on the spot and on the job, ready to work for him, to protect his hand and to look out for his interests. We are there to promote American business."

Besides Mr. Cassatt, who represents the Remington Typewriter Co., some of the other officers and directors are: J. Grant Forbes, American International Corp.; Frank Wyman Libby, Willys-Overland, Ltd.; H. H. Lukens, E. I. du Pont de Nemours & Co.; George A. Mower, Sturtevant Engineering Co., Ltd.; Walter Phillips, Westinghouse Air Brake Co.; R. P. C. Sanderson, Baldwin Locomotive Works.

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## A Letter from Chicago

By Owen M. Fox
Business News Department

Business during the month of April has been such, among machine-tool dealers in the Chicago district, as to cause a well-founded spirit of optimism to prevail, an optimism based not on theories or on a study of apparent conditions, but on the good solid basis of actual sales.

Dealers, without exception, report last month as being the best since the signing of the armistice, and several say that if each month in the year is as good as April has been they would consider it a very successful year. Sales have not been as numerous in point of number of pieces sold, but the aggregate in dollars and cents approximates good pre-war business.

Distribution is not being confined to any particular class of machinery, which is being taken as an indication of a healthy condition. Sales of lathes and of sheet-metal handling machinery seem to predominate, with all other types also being represented. No further reductions are anticipated by dealers and customers do not seem to be looking for any, as the manufacturers' expressed opinion, that cuts already made are as radical as conditions will permit, is being accepted as correct.

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## Steel Treaters' Society Holds Monthly Meeting

The regular monthly meeting of the Chicago Chapter of the American Steel Treaters' Society was held at the City Club, Chicago, on Tuesday evening, April 22. W. S. Bidle, of the W. S. Bidle Co., Cleveland, chairman of the Cleveland Chapter of the society, addressed the membership of the Chicago Chapter.

## The Spring Meeting of Mechanical Engineers

### The American Society of Mechanical Engineers Will Open Its Spring Meeting in Detroit June 16

The spring meeting of the American Society of Mechanical Engineers will open at the Hotel Statler, Detroit, on Monday, June 16, and close on Thursday, June 19. The professional program comprises the following features:

#### Aims and Organization to be Discussed

Monday, June 16—Business meeting in the afternoon, followed by a general meeting at which the Society's Committee on Aims and Organization will make a preliminary report. There are representatives on this committee from the various sections of the society and seven members at large, constituting a committee of over thirty members. Several meetings have been held by this representative group in order to bring out the sentiment of engineers from different parts of the country as to what should be the controlling elements in an engineer's work under present conditions, what constitutes engineering as a profession and what are the really important functions of an engineering society in its service to engineers and the public.

#### Papers on Industrial Research

Tuesday, June 17—Morning session on the subject of Research under the auspices of the Research Committee of the A. S. M. E. Several papers and reports will be presented. This is to be made a leading subject of the meeting because of the great impetus which has been given to industrial research as a result of the conditions resulting from the war.

#### What Conditions Are Necessary for Industrial Peace?

The afternoon session on Tuesday will be on the subject of Industrial Relations, with several addresses by men of national reputation. This session will constitute a symposium by leading organizers on the factors dominant in the labor situation, with an interchange of views as to what must be done to assure industrial peace.

#### Papers to Be Contributed by Local Sections

Wednesday, June 18—There will be a session in charge of the Detroit local committee and of several of the other sections of the society, with technical papers contributed by members of these various sections; also Gas Power Session with papers on Oil Engines.

Thursday, June 19—Miscellaneous

technical sessions, one of which will be for the discussion of fuels, including powdered fuel and oil fuel.

The Detroit local committee is arranging many events for the entertainment of the members of the society and others who may attend. Among these will be an afternoon and evening devoted to a boat ride on the lake during which dinner will be served.

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### Engineers' Club Organized in Youngstown

An Engineers' Club has been organized at Youngstown, Ohio, with nearly 550 charter members, made up largely of mechanical and civil engineers and others connected in official capacities with the various blast furnaces and steel companies in the Mahoning and Shenango Valleys. The new club is planning the erection of a building to contain the usual club facilities.

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### Electric Hoist Association Elects Officers

The Electric Hoist Manufacturers' Association has elected the following officers: Chairman, C. W. Beaver, Yale & Towne Manufacturing Co., New York; vice chairman, J. B. Adams, Franklin Moore Co., Winsted, Conn.; secretary-treasurer, W. C. Briggs, Shepard Electric Crane and Hoist Co., New York; executive committee, the above officers and S. H. Libby, Sprague Electric Works, Bloomfield, N. J., and A. J. Barnes, Shepard Electric Crane and Hoist Co., Montour Falls, N. Y.

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### New York Engineers Hold Meeting

A meeting of the New York Chapter of the American Association of Engineers was held at the United Societies Building, Wednesday, Apr. 23. The principal speaker was Robert M. MacBride, a publisher and journalist, who went to Europe with the party of journalists who accompanied President Wilson, and visited the battlefields of of France and occupied Germany.

The next meeting of the chapter will be held at the United Societies Building on May 14, at which time the newly elected officers for the ensuing year will take office.

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### Ford Street Car Coming Next

Henry Ford and the engineers of his tractor organization, it is reported, are working on plans for a street car driven by an internal combustion engine, which will be demonstrated in Detroit this summer, according to Charles E. Sorensen, general manager of the Henry Ford & Son tractor plant.

Lieut.-Col. E. J. Hall, one of the designers of the Liberty engine, will go to Detroit to assist in the demonstration of the new car. He has already successfully worked out engine-driven street cars, but will coöperate with Mr. Ford in perfecting the latter's new idea.

### New Restaurant Opened for Employees

The firm of Henry Disston & Sons, Inc., Philadelphia, Penn., has opened an employees' restaurant, in which it will sell food at cost price. This restaurant is known as the "Disston Cafeteria," and was designed with the view of accommodating 900 people and having kitchen facilities to prepare 1500 meals at one time.

## Business Items

Sleeper & Hartley, Inc., Worcester, Mass., has secured through its French agent, Edgar Bloxham, an order from the French High Commission for a considerable quantity of wire-nail machinery amounting to more than 100 machines, which in addition to its regular orders will make it necessary to double its staff and operate two shifts. This equipment will be used in reconstruction work in France.

Rivett Lathe and Grinder Co. has recently made arrangements with the following concerns to represent it exclusively as selling agents in the following territories: Metropolitan New York, western part of Connecticut, northern part of New Jersey, Patterson, Gottfried & Hunter, Inc., 211 Center St., New York; all of New York except that part in the southeastern corner which is accessible from New York City, Homer Strong, 301-309 State St., Rochester, N. Y.; the eastern half of Pennsylvania, the southern half of New Jersey, Delaware and Maryland, D. Nast Machinery Co., Bourse Building, Philadelphia, Penn.; that part of Michigan known as the lower peninsula, J. R. Stone Tool and Supply Co., 997 Woodward Ave., Detroit, Mich.; the entire Dominion of Canada, H. W. Petrie, Ltd., corner Niagara and Bathurst Sts., Toronto, Canada.

C. W. Rice, secretary of the American Society of Mechanical Engineers, was the speaker at a joint meeting of the Omaha Technical Club and the Nebraska Association of Civil and Mechanical Engineers, Apr. 14. Howard J. Webster, president of the Uniflow Boiler Co., Philadelphia, Penn., was another speaker, taking as his topic, "Combustion Engineering." J. A. Bruce, city engineer of Omaha, was the presiding officer.

The Engineers' Club of St. Louis discussed the McCullough-Martin road bill, relating to state roads, at the meeting held Apr. 16. Louis J. Brooks, John W. Woermann, A. P. Greensfelder, J. C. Trevilla, W. W. Horner, Walter Heimbucher, J. M. Slater, C. W. Roehrig, William Elbring, and William Stocker were the speakers.

The Nilson Die and Tool Co., Chicago, Ill., announces that it has taken over the Strand Machinery Co., and is now furnishing the Strand pneumatic die cushions to the trade.

The Chicago Pneumatic Tool Co. announces the election of Allan E. Goodhue as managing director of its English subsidiary, the Consolidated Pneumatic Tool Co., Ltd., whose offices are at 170 Piccadilly, London, and whose plant is in Fraserburg, Scotland. Mr. Goodhue will also be in charge of European sales for the Chicago Pneumatic Tool Co.

The executive office of Slocum, Avram & Slocum moved on May 1 to the 40th floor of the Woolworth Building, New York City.

Norman Hatton, Wm. J. Klein and S. E. Holmes of Cedar Rapids, Iowa, announce the formation of a partnership under the name of Hatton, Klein & Holmes.

The Thermal Appliance Co., Inc., has moved into its new manufacturing plant and headquarters which are located at Port Ave. and Third St., Elizabethport, N. J.

Booth & Stewart, consulting engineers, have recently established offices at 410 Press Building, Kalamazoo, Mich. K. W. Booth was formerly assistant engineer for Fuller & Son and H. M. Stewart was chief engineer for the Lane Motor Truck Co., both of the same city.

## Personals

M. M. GRUBER, formerly assistant chief draftsman of the Hill Publishing Co., and for the past two years president and mechanical engineer of the Presto Machine Works, Inc., Brooklyn, N. Y., has been elected secretary of the Presto Phono Parts Corporation, an allied interest to the machine corporation. Mr. Gruber, who is a member of the American Society of Mechanical Engineers, will act as mechanical engineer to both corporations.

LIEUT.-COM. H. J. ELSON, U. S. Naval Reserve Force, has been released and has resumed his civilian work as secretary and treasurer of the Walter A. Zelnicker Supply Co., St. Louis. He was formerly with this company in charge of internal management and manufacturing operations. Lieutenant Elson will have the general internal management of operations and manufacturing of the Zelnicker Co., and its various allied subsidiaries.

CAPT. THOS. F. GITHENS has been discharged from the U. S. Army and is now employed by the Cleveland Twist Drill Co., Cleveland, Ohio.

HERMAN A. HOLZ, has moved his office and laboratories from 1 Madison Ave. to the Pullman Building, 17 Madison Ave., New York.

ENSIGN FRED D. RICE, U. S. Naval Reserve Forces, has been released from active service and is now representing the Hess Steel Corporation, Baltimore, Md., in Western New York and Western Pennsylvania.